MOLGROUP
THINK. CREATE. MOVE.




EOR-IOR APPLICATIONS IN MOL'S PRACTICE

János Szelényi

Production Technology Advisor
MOL Group Reservoir Engineering

Islamabad, Pakistan
7 May 2015

DISCLAIMER

This presentation and the associated slides and discussion contain forward-looking statements. These statements are naturally subject to uncertainty and changes in circumstances. Those forward-looking statements may include, but are not limited to, those regarding capital employed, capital expenditure, cash flows, costs, savings, debt, demand, depreciation, disposals, dividends, earnings, efficiency, gearing, growth, improvements, investments, margins, performance, prices, production, productivity, profits, reserves, returns, sales, share buy backs, special and exceptional items, strategy, synergies, tax rates, trends, value, volumes, and the effects of MOL merger and acquisition activities. These forward-looking statements are subject to risks, uncertainties and other factors, which could cause actual results to differ materially from those expressed or implied by these forward-looking statements. These risks, uncertainties and other factors include, but are not limited to developments in government regulations, foreign exchange rates, crude oil and gas prices, crack spreads, political stability, economic growth and the completion of ongoing transactions. Many of these factors are beyond the Company's ability to control or predict. Given these and other uncertainties, you are cautioned not to place undue reliance on any of the forward-looking statements contained herein or otherwise. The Company does not undertake any obligation to release publicly any revisions to these forward-looking statements (which speak only as of the date hereof) to reflect events or circumstances after the date hereof or to reflect the occurrence of unanticipated events, except as maybe required under applicable securities laws.

Statements and data contained in this presentation and the associated slides and discussions, which relate to the performance of MOL in this and future years, represent plans, targets or projections.

Contents

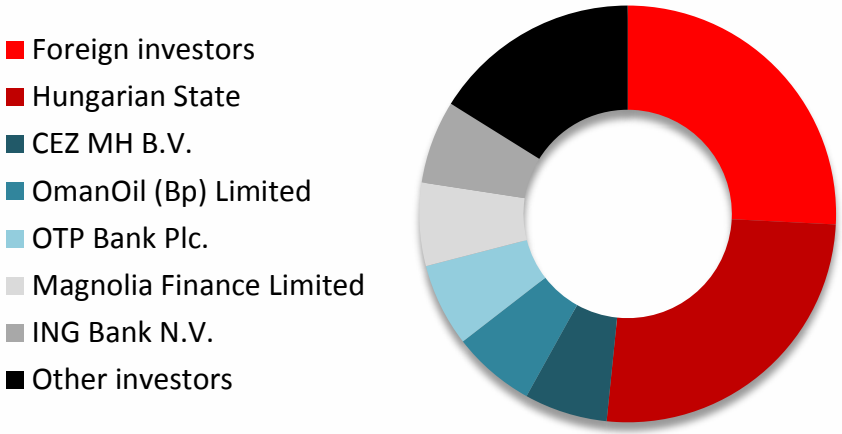
1. Oil and gas in Hungary

ABOUT MOL GROUP

MOLGROUP is a leading international, integrated oil and gas company from Hungary, the heart of Europe, with over 75 years' experience and a proven track record.

In addition to the company's strong refinery and commercial position in the CEE region, increasing focus is now being given to its exploration and production assets where MOL Group has over two decades of presence.

OWNERSHIP STRUCTURE 2014



CORE ACTIVITIES

ABOUT MOL GROUP |

40 COUNTRIES

of operations in Europe, Middle-East, Africa and Asia

38 MILLION BARRELS

of oil-equivalent Hydrocarbons are produced annually which could fill a tanker train 1206 km long

AROUND 29.000 EMPLOYEES

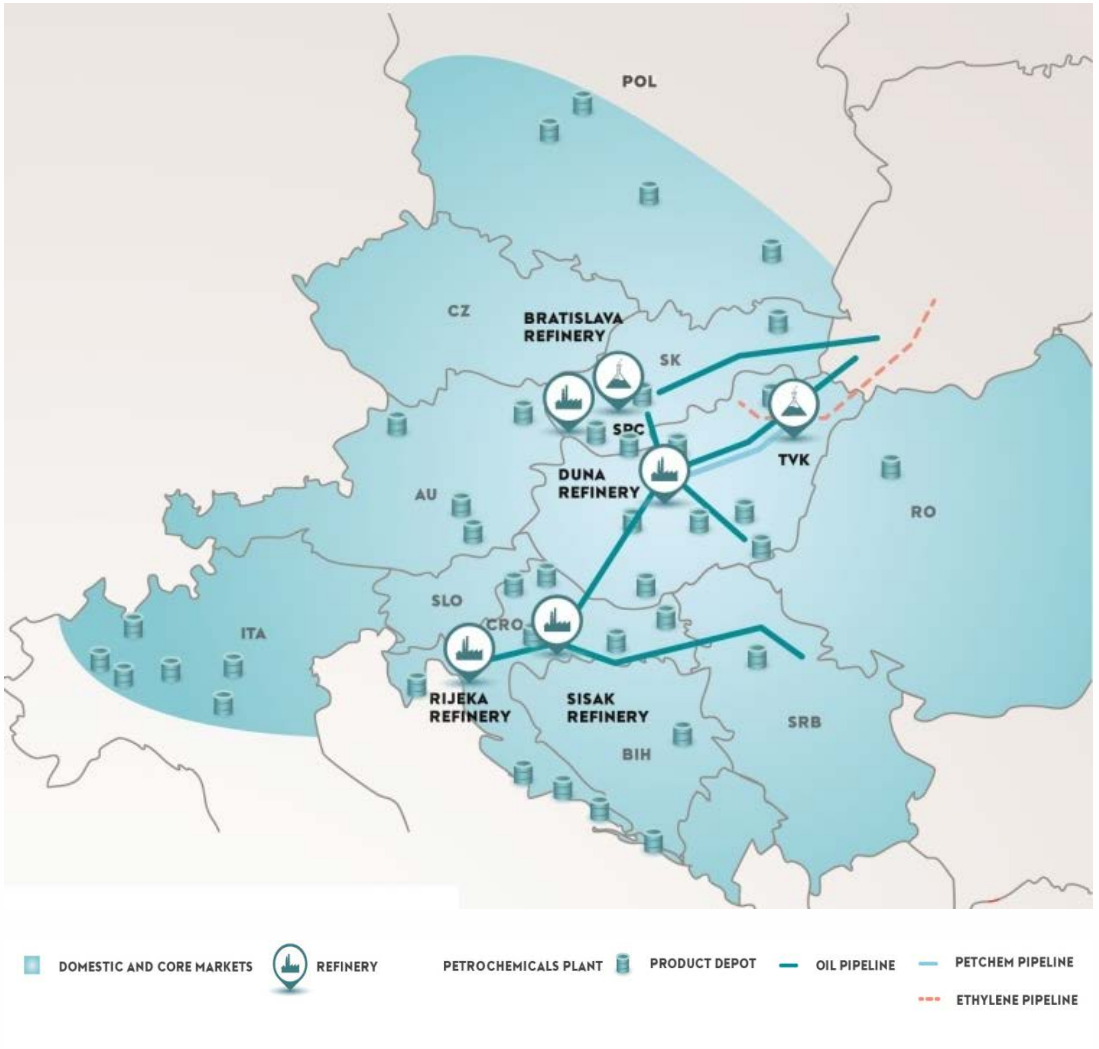
worldwide

Members of MOL Group

Strategic members of MOL Group

MOL Group Downstream operations:

- 6 production units
- Total capacity of 20.9 mtpa refining and 2.1 mtpa petrochemicals
- 1734 service stations
- 8 brands
- Presence in 11 CEE countries
- All operations are supported by a far-reaching logistics system and driven by Supply Chain Management.

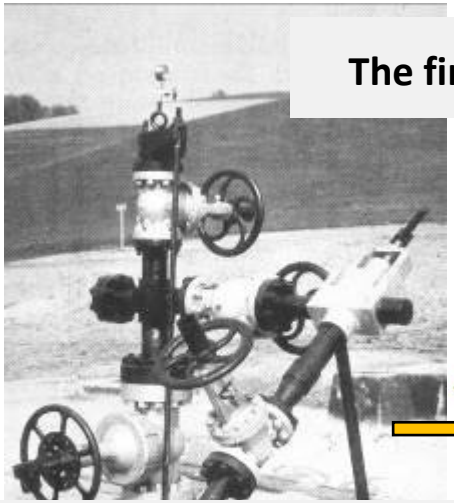


MOL GROUP UPSTREAM

MOL Group Upstream operations:

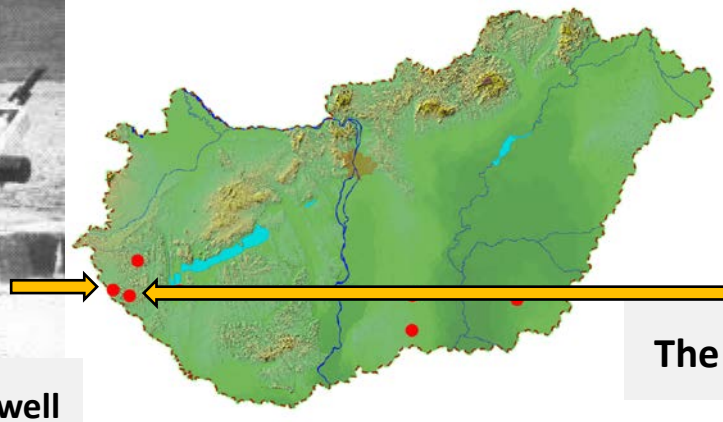
- Exploration assets in 13 countries
- Producing assets in 8 countries
- Strong presence in the CEE region with excellent cash-flow generation
- Diversified portfolio: Middle-East, Africa, CIS, Pakistan, North Sea

History of the Hungarian Petroleum Industry



The Budafa-2 discovery well

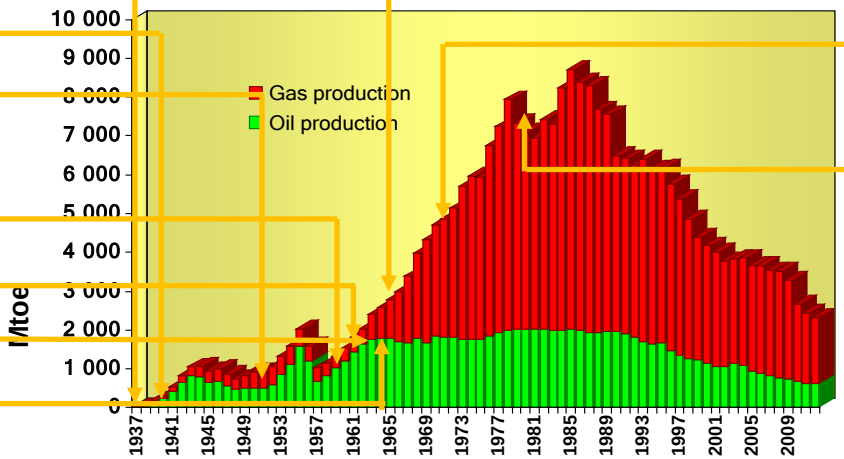
The first discovery: Budafa (1937)



The second discovery: Lovászi (1940)

Top 10 discovery in red

1937 – Budafa
1940 – Lovászi
1951 – Nagylengyel
1955 – Demjén
1959 – Pusztaföldvár
1961 – Hajdúszoboszló
1962 – Üllés
1964 – Szank

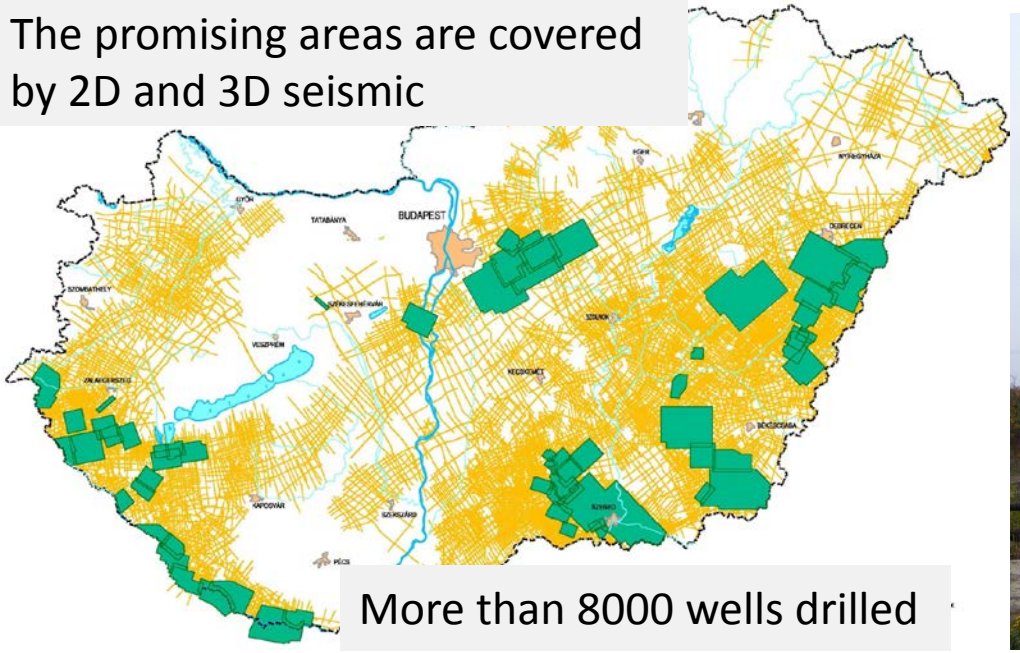


1965 – Algyő
1971 – Szeged-Mórav.
1977 – Kiskunhalas
1980 – Szeghalom
1982 – Kiskundorozsma
1985 – Endrőd
1992 – Mezősas-W
1995 – Sávoly-SE

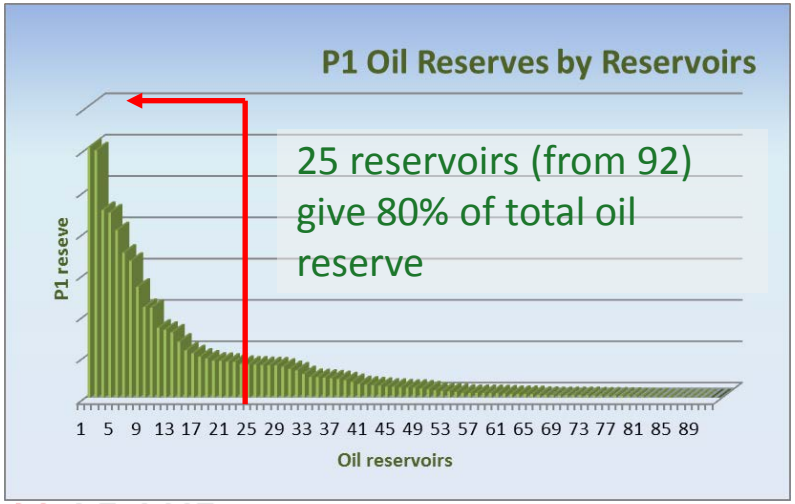
MOLGROUP

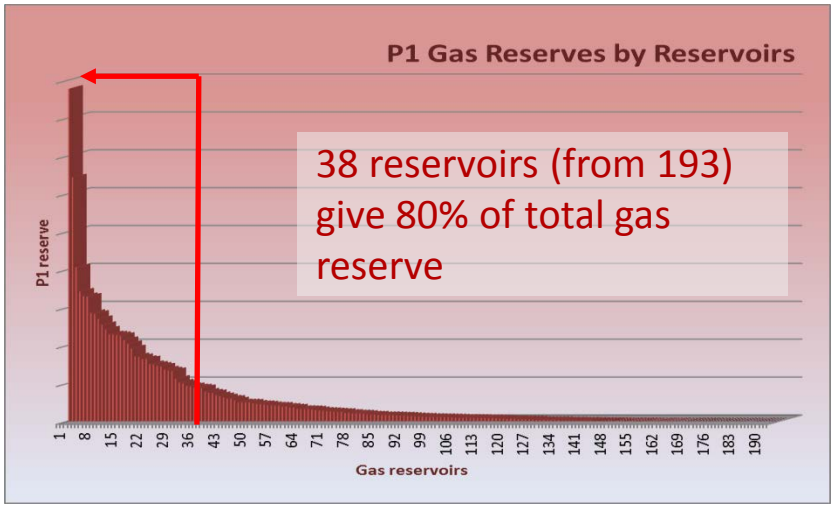
Hungary is a mature ground for HC exploration and production

The promising areas are covered by 2D and 3D seismic



More than 8000 wells drilled





MOLGROUP

The Hungarian ‚Playground'

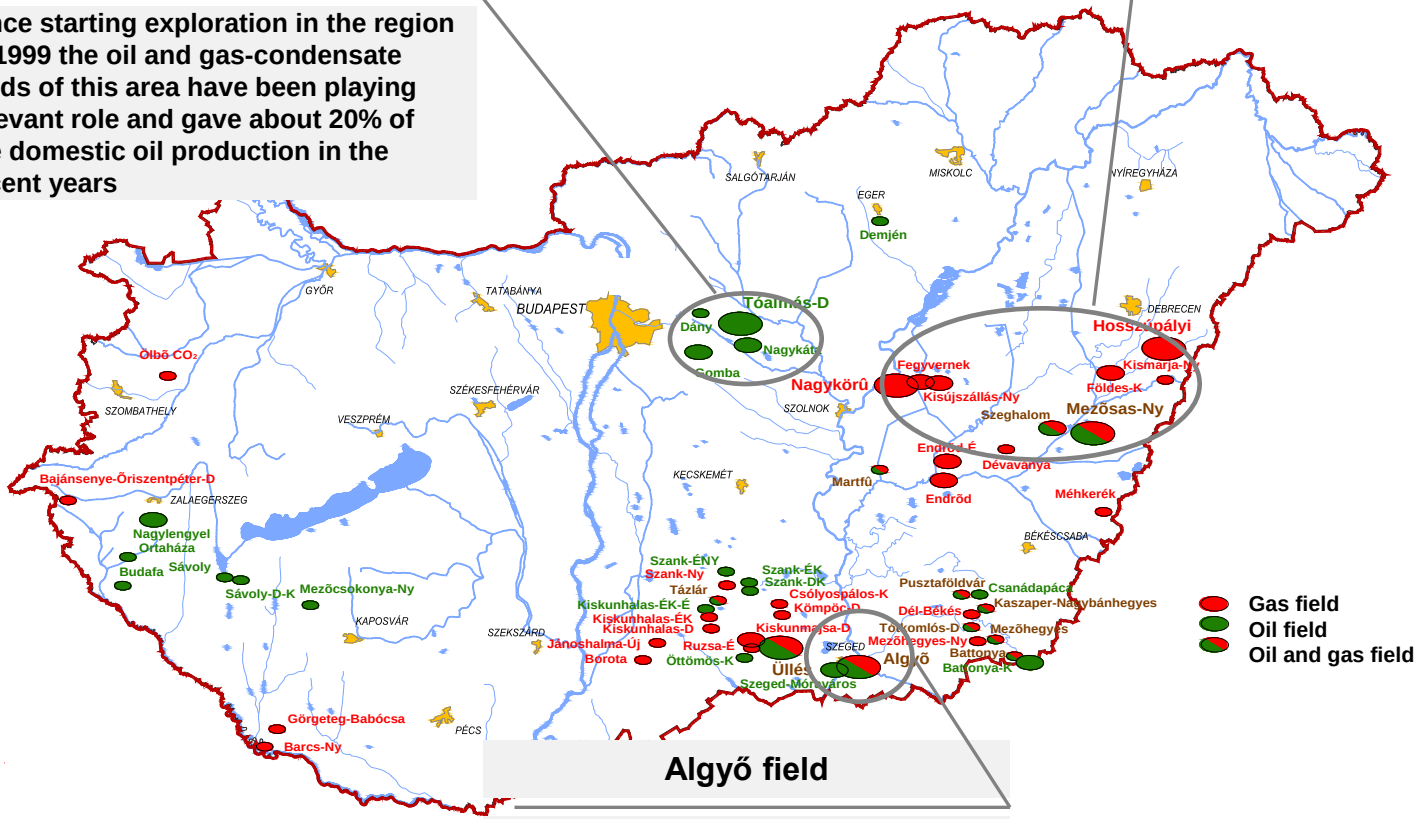
Main Producing areas

Paleogene region

Since starting exploration in the region in 1999 the oil and gas-condensate fields of this area have been playing relevant role and gave about 20% of the domestic oil production in the recent years

East Hungarian Gas fields

A few newly discovered fields with considerable potential gave about 10% of the domestic gas production in the recent years



Algyő field

Still dominant area, Algyő gave about 40% of the domestic oil and gas production in the recent years

MOLGROUP

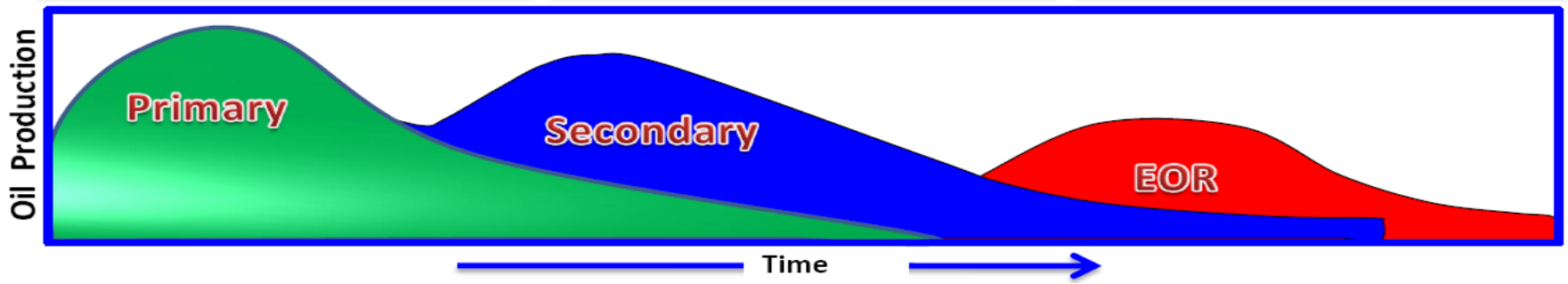
Contents

2. Portfolio management and screening

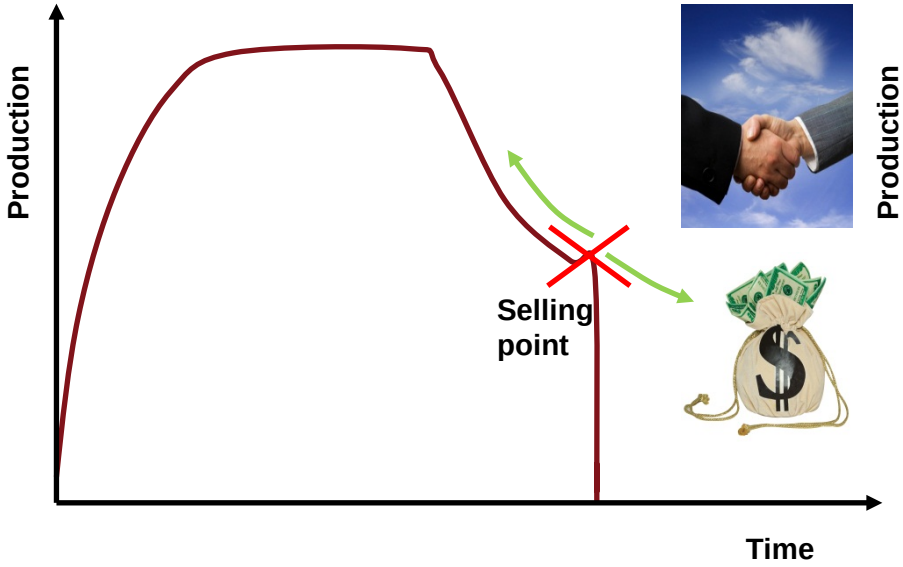
Keeping or selling?

What is the concept of handling the production portfolio? Main questions:

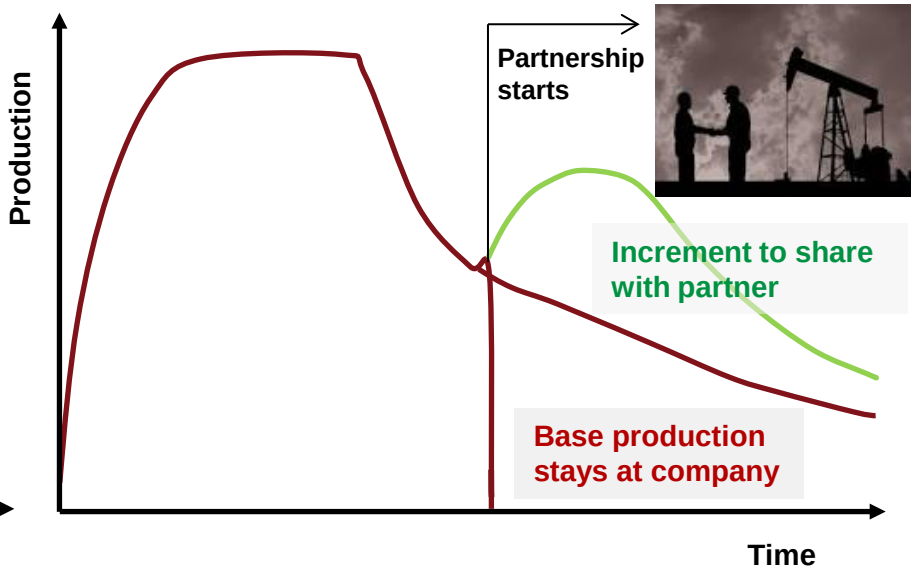
From cradle to grave? Playing the whole story and squeeze out the last HC molecule?



Selling and buying?

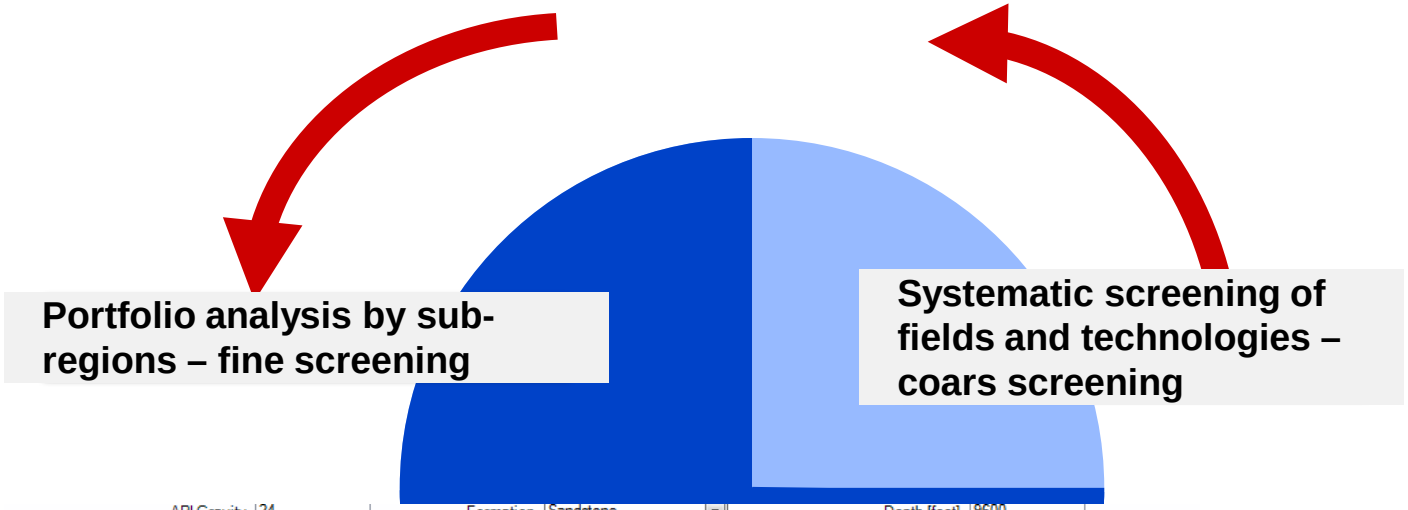


Risk and capacity sharing with partner?



If we decide to expand the life of the fields…

Cyclic Screening Process



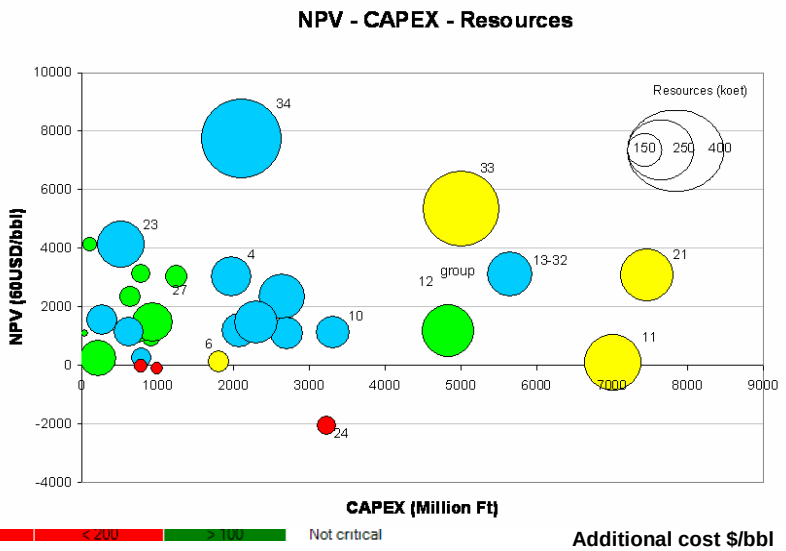
Portfolio analysis by sub-regions – fine screening

Systematic screening of fields and technologies – coars screening

API Gravity	24	Formation	Sandstone
Oil viscosity [cP]	0.92	Thickness	> 20 ft With Dip
Oil Saturation, fraction	0.68	Composition	High % C5-C12

Summary Screening | **Detail**

Properties	Nitrogen and flue gas	Hydrocarbon	Carbon Dioxide	Immiscible Gases	Miscellar/polyı ASP, and alka flooding
Oil API Gravity	> 35 Average 48	> 23 Average 41	> 22 Average 36	> 12	> 20 Average 3
Oil Viscosity (cp)	< 0.4 Average 0.2	< 3 Average 0.5	< 10 Average 1.5	< 600	< 35 Average 1
Composition	High % C1-C7	High % C2-C7	High % C5-C12	Not critical	Light, intermed Some organic a for alkaline flo
Oil Saturation (PV fraction)	> 0.40 Average 0.75	> 0.30 Average 0.80	> 0.20 Average 0.55	> 0.35 Average 0.70	> 0.35 Average 0.5
Formation Type	Sandstone or Carbonate	Sandstone or Carbonate	Sandstone or Carbonate	Not critical	Sandstone preferred
Net Thickness (ft)	Thin unless dipping	Thin unless dipping	Wide range	Not critical if dipping	Not critica
Average Permeability (md)	Not critical	Not critical	Not critical	Not critical	> 10 md Average 450
Depth (ft)	> 6000	> 4000	> 2500	> 1800	< 9000 Average 32
Temperature (deg F)	Not critical	Not critical	Not critical	Not critical	< 200



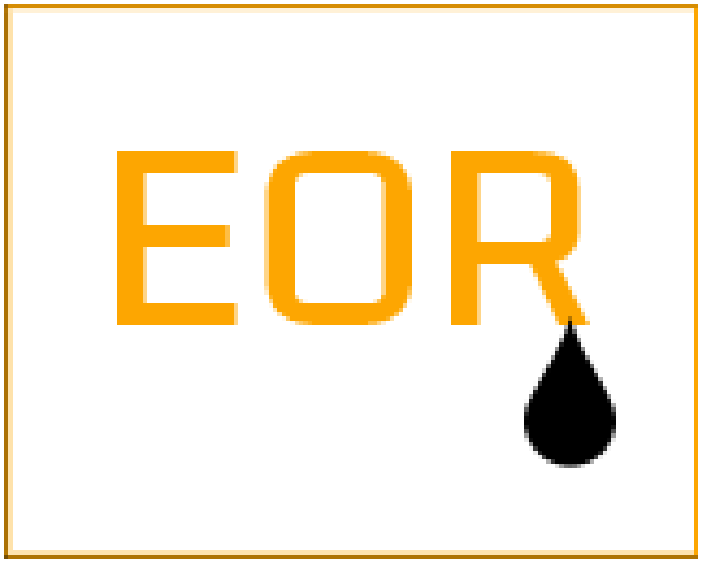
< 200 | > 100 | Not critical

Additional cost $/bbl

MOLGROUP

Focus on RF improvement – EOR Team from 2013

- **regular screening** of MOL Group producing or non-producing field portfolio for possible **EOR/IOR** and **EGR/IGR** applications,
- **generating** EOR/IOR and EGR/IGR **projects**,
- **accelerating implementation** of projects,
- **project surveillance** and analysis of results,
- **harmonizing EOR/IOR related R&D projects with EOR/IOR strategy** and support/accelerate their implementation,
- **generating new** EOR/IOR related **R&D projects**,
- **supporting lobby activity with government offices** (more incentive regulations regarding EOR/EGR).



Old screening results and new revision in 2013

- **Screening of Hungarian**
- 7 EOR project
- 4 EGR project
- 5 IOR project
- 3 IGR project

on the basis of NPV and

Fields for EOR projects	Proposed technology	Probability of success
Öttömös-East	Secondary gas cap (CO2/N2)	>50
Ásotthalom	Secondary gas cap (CO2/N2)	>50
Sávoly-SE Triassic oil reservoirs	Secondary gas cap (CO2/N2)	>50
Kiskundorozsma	Secondary gas cap (CO2/N2)	>50
Budafa (Zala-Kerettye)	CO2 flooding	?
Nagylengyel, Barabássz., Ortah., Pusztaap.	Secondary gas cap (CO2)	?
Budafa (Budafa-3 East)	Gasoline + CO2 flooding	?

Kiskunhalas - ÉK Északi metamorf	IOR	modifications; periodical production of old	Project is under re-evaluation

Fields for EGR projects	Proposed technology	Probability of success
Pusztaföldvár Felső A-3	HC gas exchanging with CO2	>80
Üllés (Miocene reservoir)	HC gas exchanging with CO2	>50
Őriszentpéter-S gas condensate	HC gas recycling	?
Szank (Miocene reservoir)	HC gas exchanging with CO2	?

Endrőd-Észak	IOR	Drilling of 1 new well	Cancelled

Potential increment: 1 100 koet

Forráskút	IOR	Copletion of one well and fracturing	Not economical
Budafa / Budafa-3 K Kelet	EOR	Gasoline and CO_2 injection	Not economical

MOLGROUP

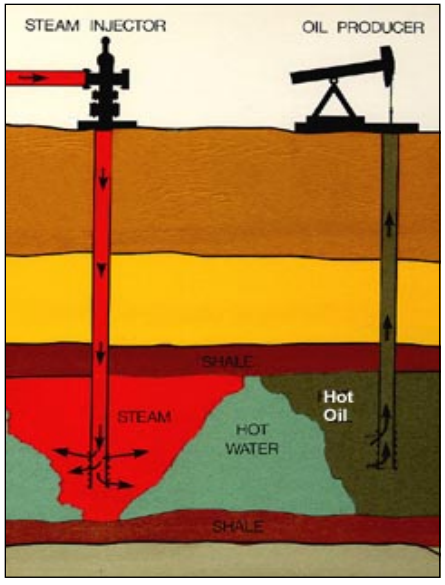
Contents

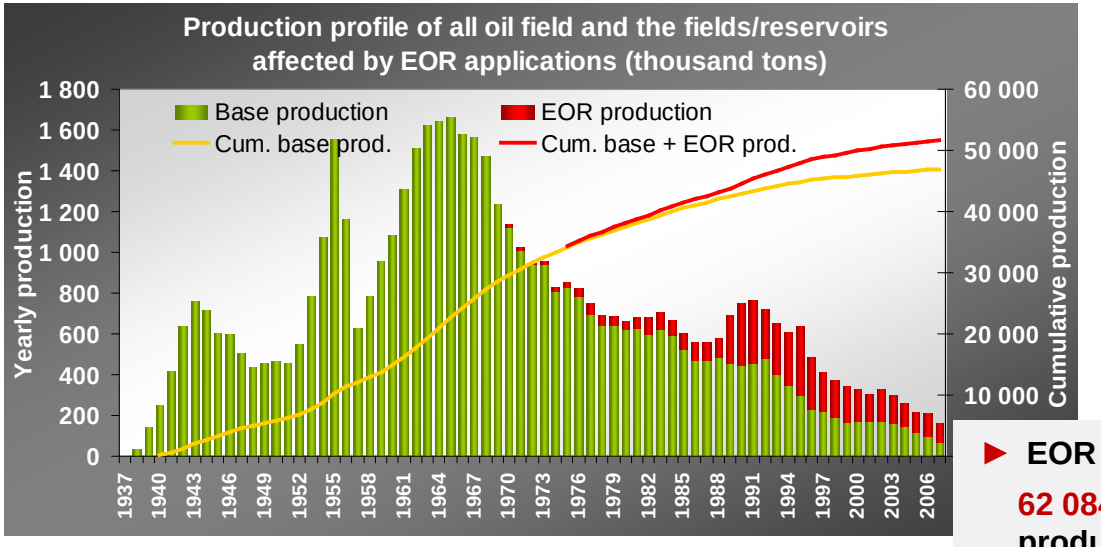
3. 40 years EOR experience

MOL has serious experience in IOR/EOR applications

IOR Applications

- Two sided / simultaneous **water injection** (GOC and WOC)
- Multifunctional application of **horizontal well** technology
- **In-fill drillings**
- **Conformance control** in oil and gas wells
- **Fracturing** in low perm reservoirs





EOR Applications

- **CO_2 flooding** in carbonate and sandstone reservoirs (Nagylengyel, Szank oil fields)
- **CO_2 flooding combined with water injection** in sandstone reservoirs (Budafa, Lovászi, Pusztaföldvár fields)
- **Methane injection** into an extra light oil reservoir (Algyő field, Tisza-1 reservoir)
- **Ethane rich gas injection** into a light oil reservoir (Algyő field, Tisza-2 reservoir)
- **Nitrogen injection** into a fractured metamorphic type oil reservoir (experimental, Kiskundorozsma field)
- **Thermal methods** (In-situ combustion, steam injection) in Demjén oil field
- **Microbiological EOR** in Demjén oil field

Results of EOR

- **EOR production in 2014:**
  62 084 t – equal 11.2% of total Hungarian oil production
- **EOR applications in Hungary resulted near to 5 million tons of oil from the beginning (from 1969)**

MOLGROUP

CO_2 injection - the most frequent EOR application

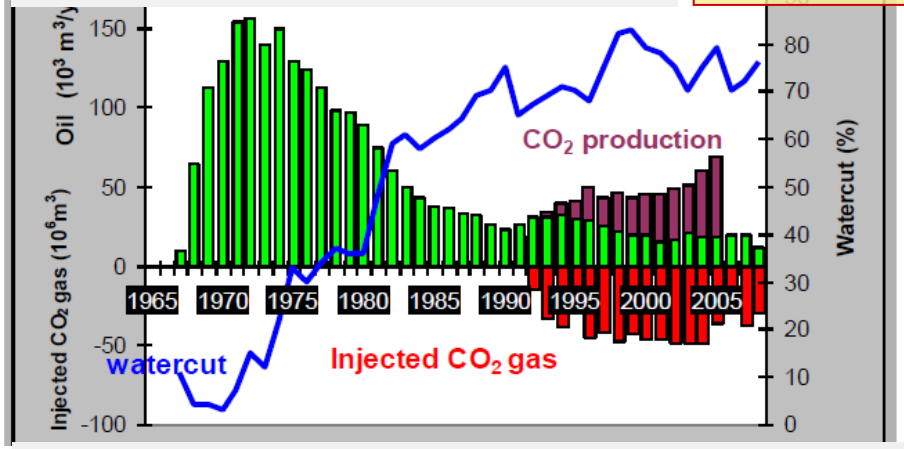
1953: Laboratory-scale CO_2 flooding tests

1960's: Pilot tests of CO_2 injection in Lovászi and Budafa fields

1972: Field-scale CO_2 injection started in Budafa Field

1975: Field-scale CO_2 injection started in Lovászi Field

1992: Field-scale CO_2 injection started in Szank Field



1980: Pilot tests of CO_2 injection in Nagylengyel field

1988: Field-scale CO_2 injection started in Nagylengyel Field

Budafa oil field:
893 th m^3 inc. oil

Lovászi oil field:
442 th m^3 inc. oil

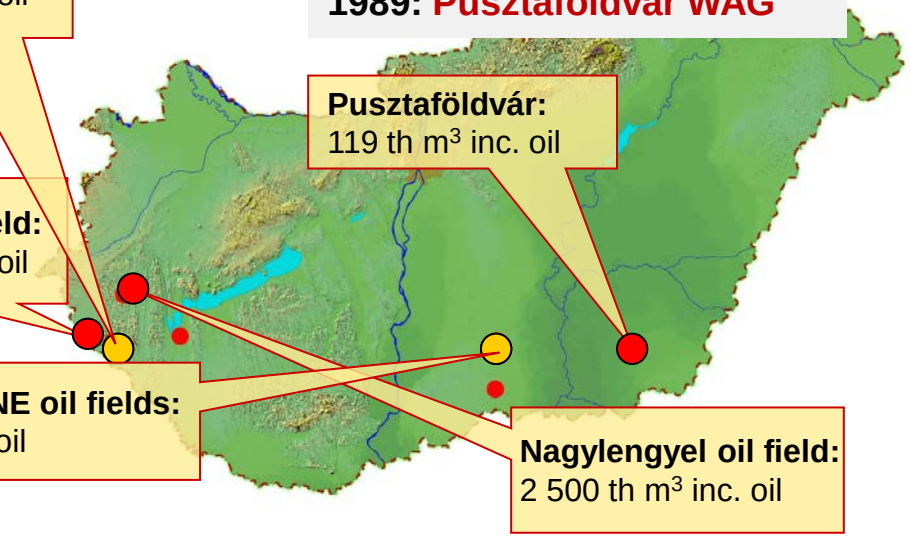
Szank–SE & NE oil fields:
115 th m^3 inc. oil

1973: Pusztaföldvár CO_2

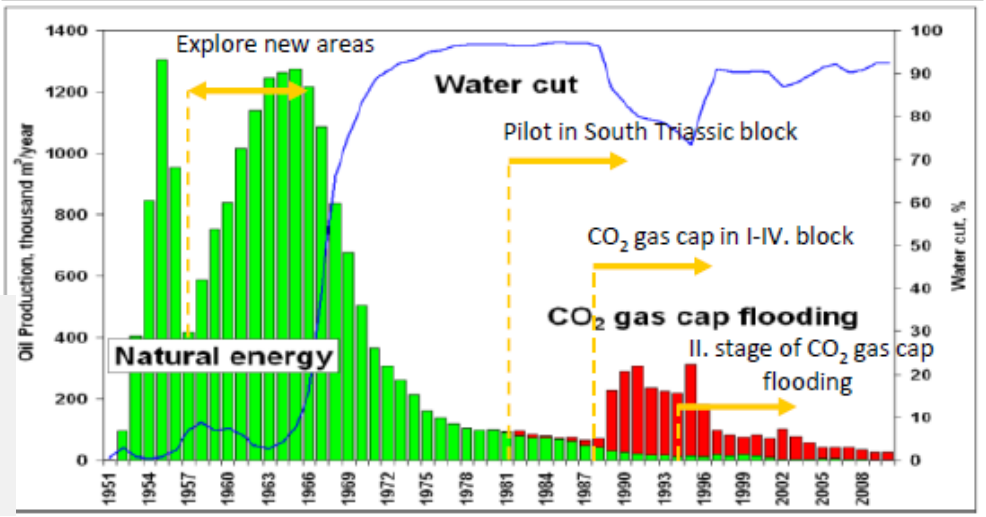
1989: Pusztaföldvár WAG

Pusztaföldvár:
119 th m^3 inc. oil

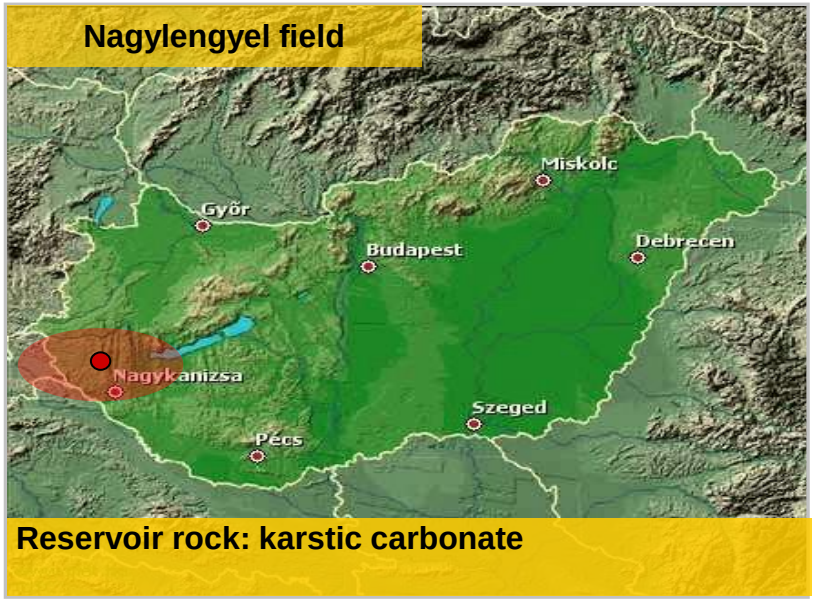
Nagylengyel oil field:
2 500 th m^3 inc. oil



Tendency of oil production in Nagylengyel field



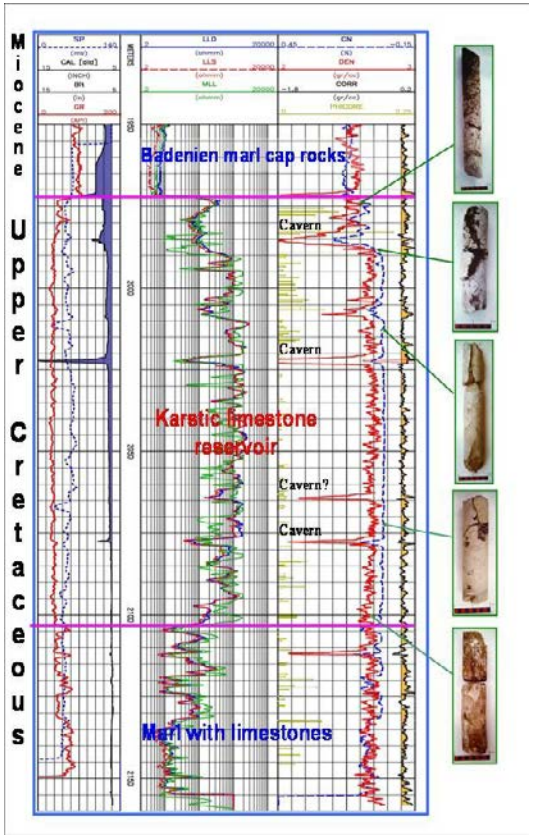
CO_2 injection in Nagylengyel carbonate field



Challenge

- Old wells, well integrity problems
- High H_2S content of the injected gas
- Corrosion
- Complex reservoir properties (karstic carbonate reservoir)
- Environmental concerns (CO_2 disposal after depletion of the field)

Temperature	C°	114
Initial pressure	bar	207
Porosity	%	1.2
Permeability	D	3.8
Oil Viscosity	mPas	19



Components of success

- Understanding the Karst System and Primary recovery (long production history, water influx)
- Natural CO_2 resource in the vicinity of the field
- Reservoir management (monitoring oil front movement)
- High standard laboratory experiments and exploitation plans

Solution

- Pilot testing
- New CO_2 well design
- Treatment CO_2 disposal
- H_2S and corrosion handling
- Field trials in two phases (Third phase of the project is under preparation now)

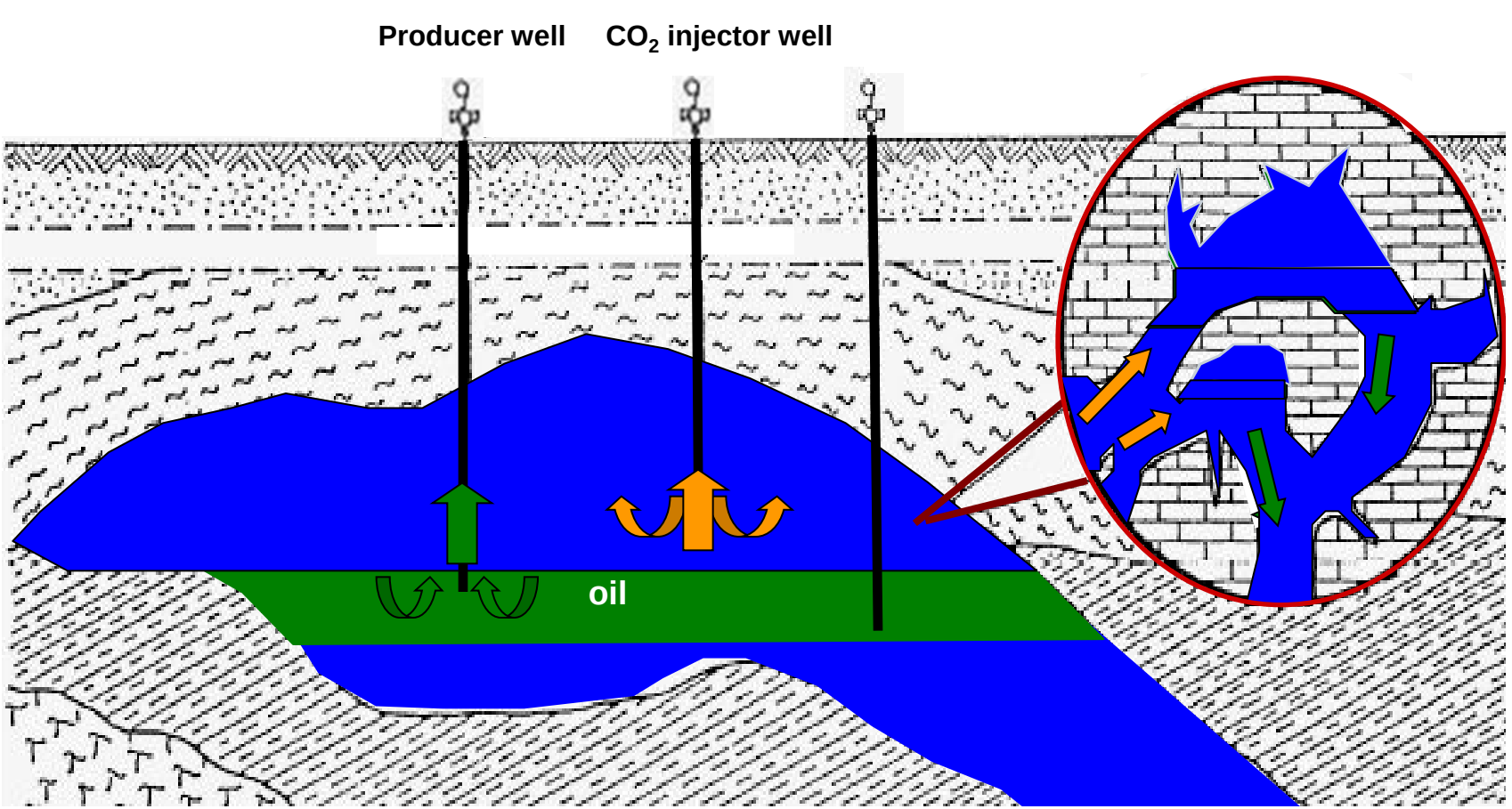
MOLGROUP

Phases of artificial CO_2 gas cap EOR process

I. Create an artificial gas cap

II. Gas withdrawal

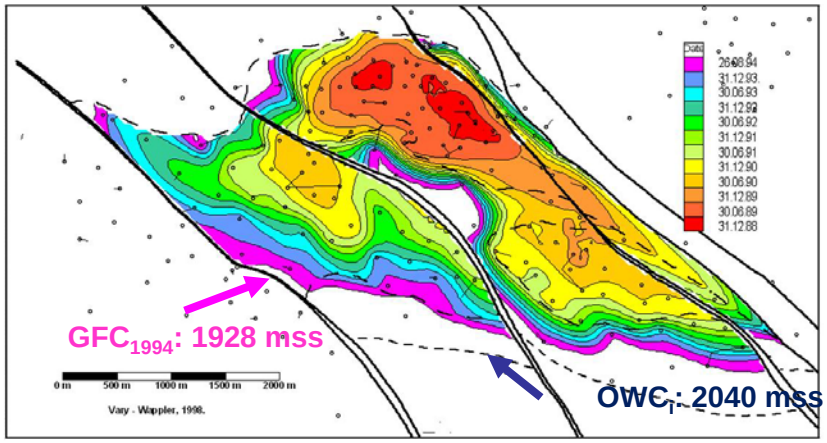
III. Oil displacement with water



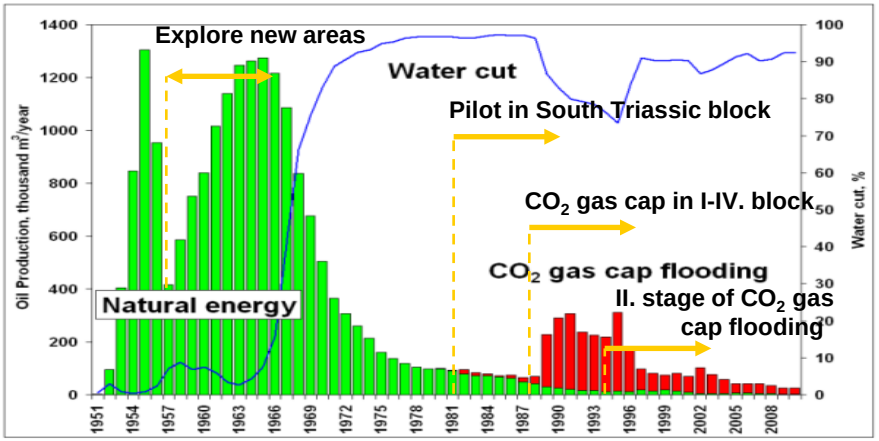
MOLGROUP

CO_2 flooding in Nagylengyel field – results and extension

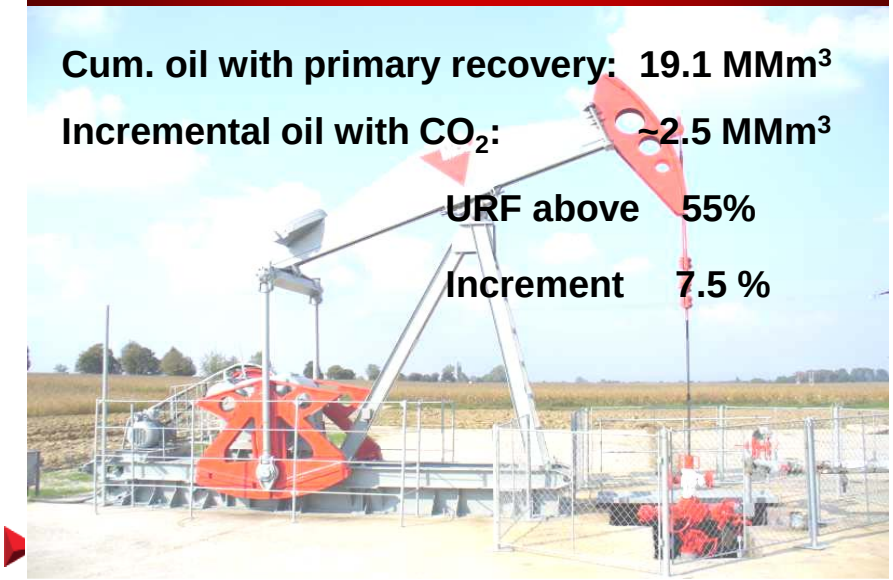
Moving of gas fluid contact during injection



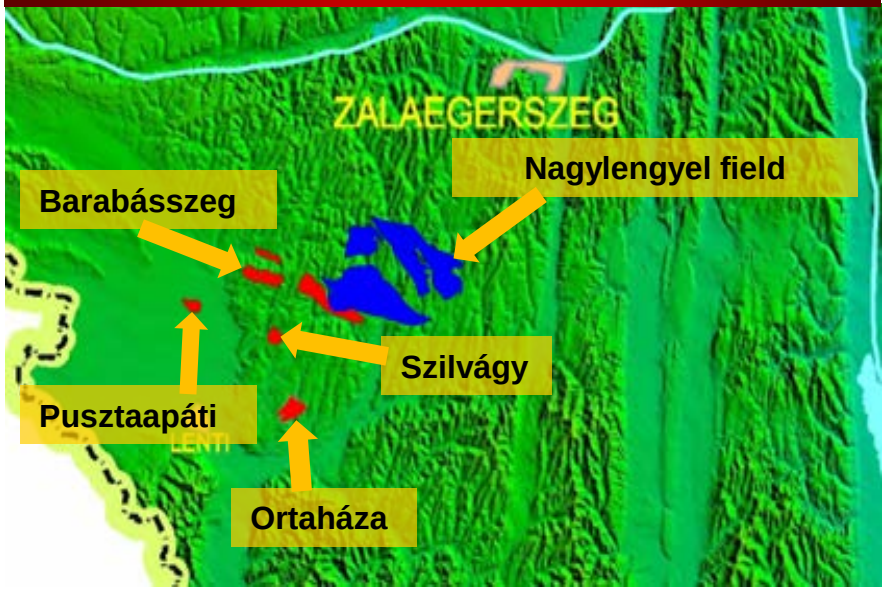
Tendency of oil production in Nagylengyel field



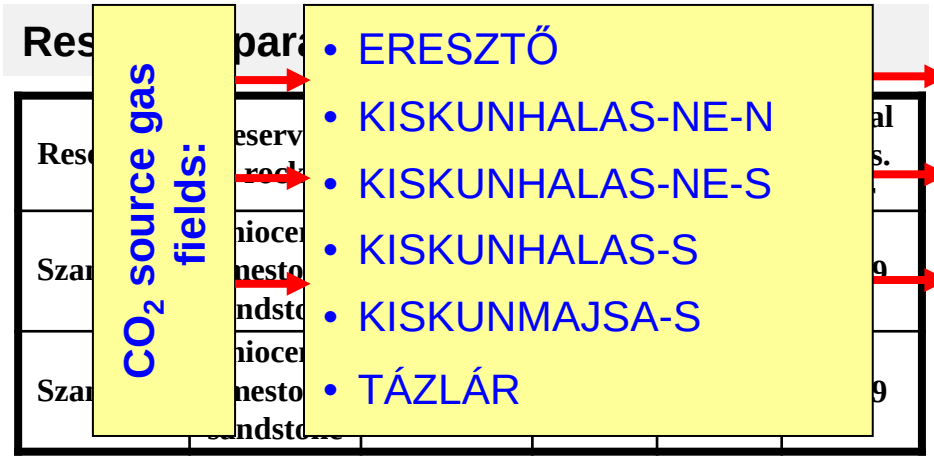
Results of CO_2 injection in Nagylengyel field



Further CO_2 injection plans in the region

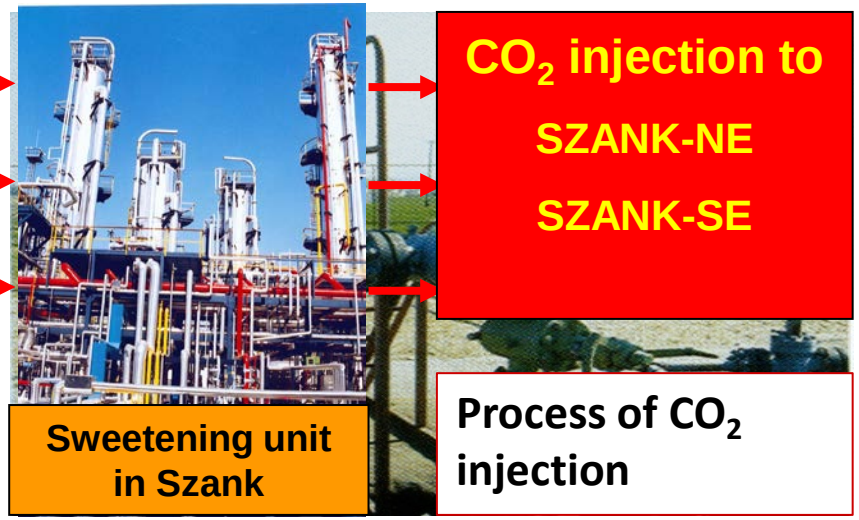


CO_2 gas flooding in Szank-NE and Szank-SE oil fields



CO_2 source gas fields:

- ERESZTŐ
- KISKUNHALAS-NE-N
- KISKUNHALAS-NE-S
- KISKUNHALAS-S
- KISKUNMAJSA-S
- TÁZLÁR



Sweetening unit in Szank

CO_2 injection to SZANK-NE SZANK-SE

Process of CO_2 injection

- **Production** started in Szank fields **between 1966-1970**
- **In 1990 water-cut reached 70%**, wells produced by beam pumps
- **9 wells** were re-completed into **injectors and a Sweetening Unit** (with amine technology) was **built in 1992**
- **CO_2 content** of the associated gas raised **up to 80 % in 2002**
- The **associated gas has been injected back** to the aquifer of Szank field **since 2003**
- In the future **corrosion** effect of CO_2 within the well bore must be considered.

Szank-SE
RF: 36,6 %
Cumulative oil: 10,5 Million bbl
EOR Oil increment: 572 thousand bbl
(RF: +2 %)

Szank-NE
RF: 42,5 %
Cumulative oil: 4,2 Million bbl
EOR Oil increment: 163 thousand bbl
(RF: +1,65 %)

RESULTS and LESSONS LEARNT

Utilization of the synergy between Sweetening Unit and EOR using CO_2 as a by-product of the capturing technology for producing extra oil

Pusztaföldvár CO_2 + WAG + Water Injection

Location of the field

OOIP: 1.06 MMcm

Reservoir parameters

Area of reservoirs	3,3 km^2 (815,4 acres)
Type of reservoirs	sandstone
OWC	1644 ssm (5392 ft)
Pi	17,45 MPa (2531 psi)
Ti	122 °C (251 °F)
Net pay	3,5 m (11,5 ft)
Porosity	20,6%
Swi	30,0%
Permeability	10 mD

Production phases of PF-A-I reservoir:

1960-1972 primary recovery (depletion + water drive)
1973-1983 CO_2 gas injection
1984-2004 WAG and water injection
- 1984-1989 planning, construction, pressure increasing
- 1990-1996 WAG injection
- 1997-2004 water injection

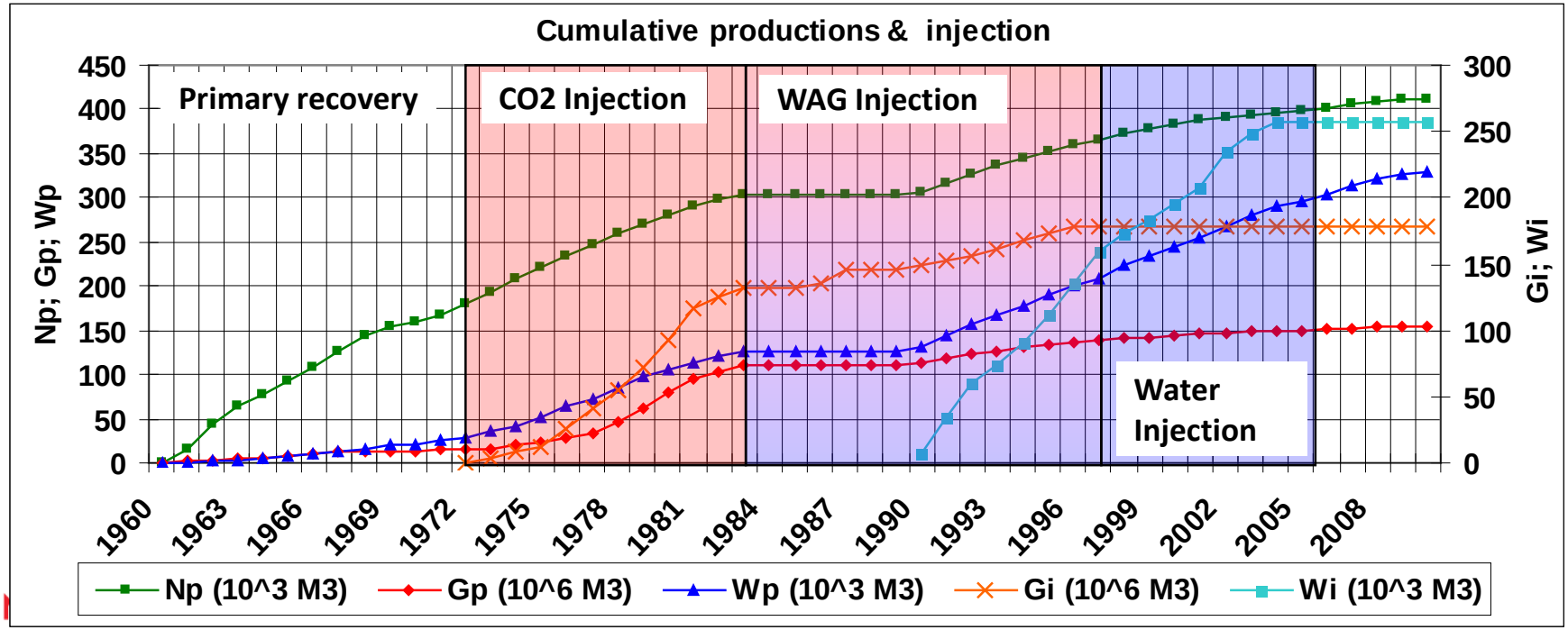
2005- „primary recovery" again

MOLGROUP

Pusztaföldvár CO_2 + WAG + Water Injection

Oil production (10^3 m^3)		**Rec.F (%)**
Primary oil rec.	293,6	27,6
CO_2 injection	**62,2**	**5,8**
WAG+water inj.	**56,8**	**5,3**
Total	412,6	38,7

Gp = 154,1*10^6 m^3
Gi = 177,5*10^6 m^3
Wp = 328,3*$10^3$$m^3$
Wi = 257,5*10^3 m^3
Pr = 17,4 ⇨ 11,8 MPa

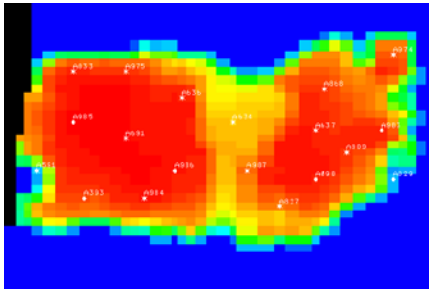


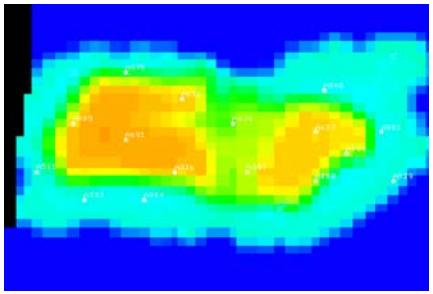
HC injection into light oil reservoir

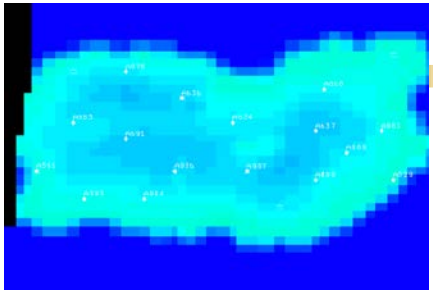
Algyő field, Tisza-1 reservoir

Natural water drive

Gas injection

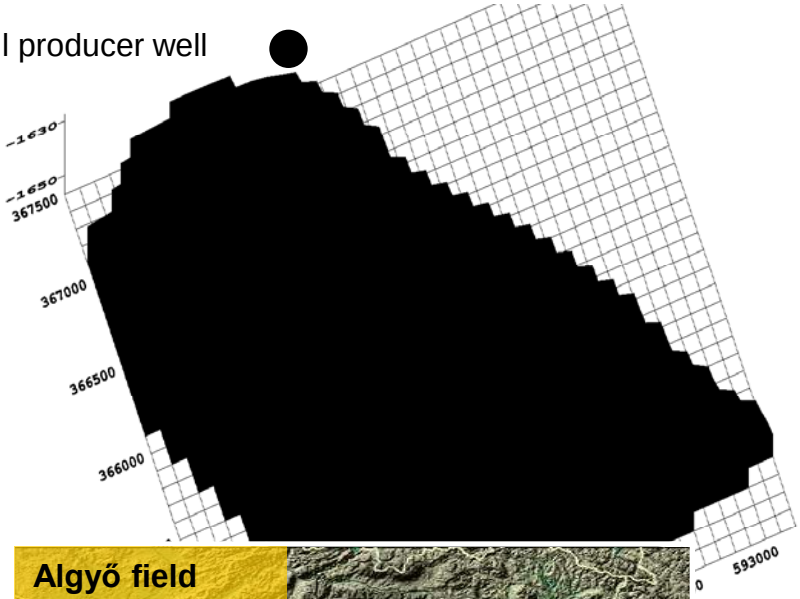


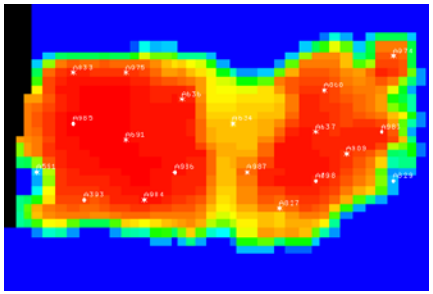


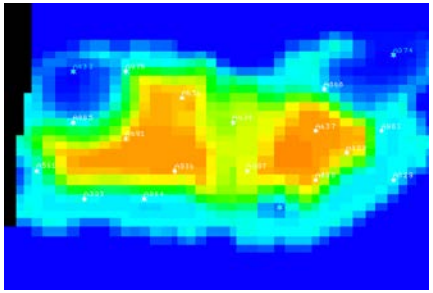


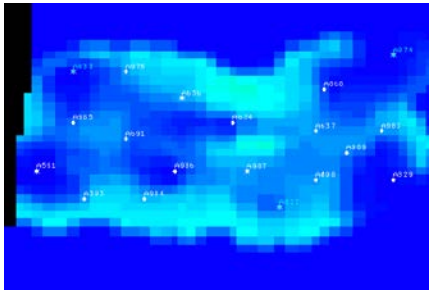
Gas injection well

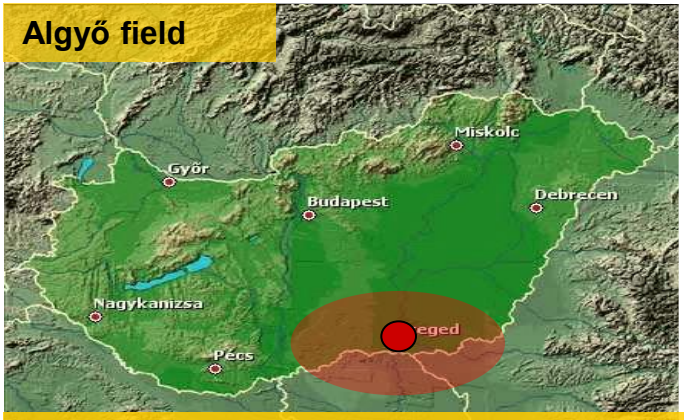
Oil producer well











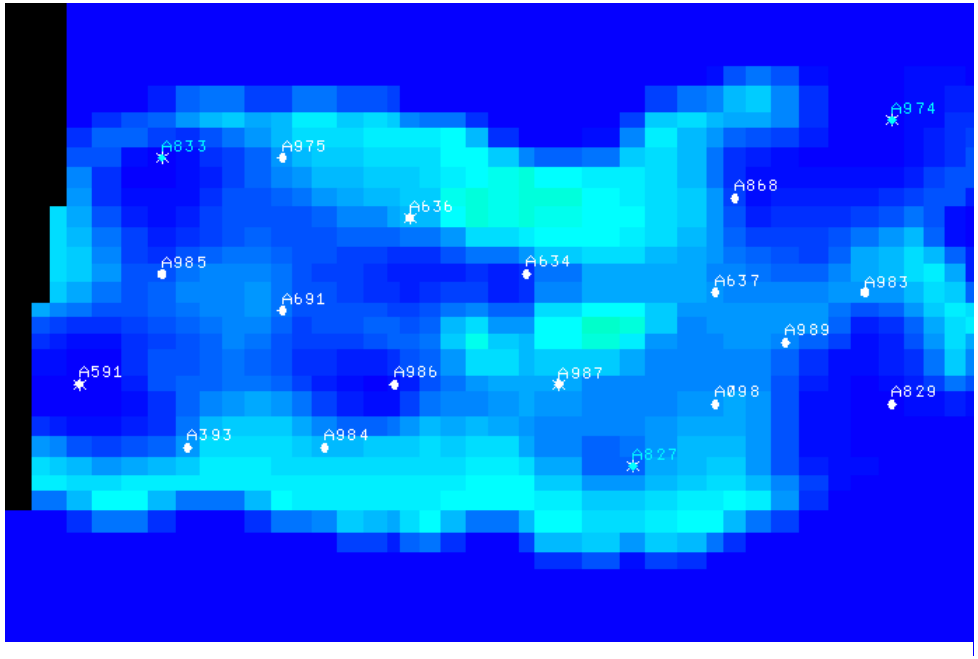
Enhanced recovery of C3-6 components in selected water flooded areas

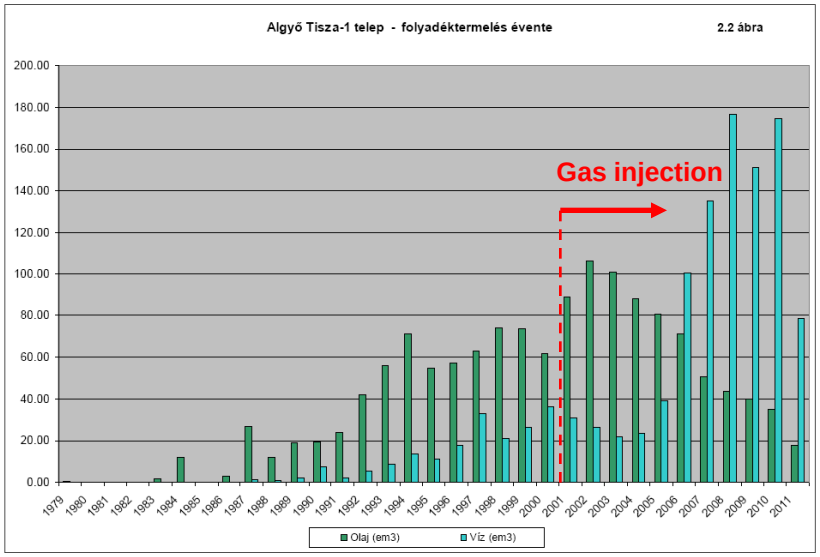
MOLGROUP

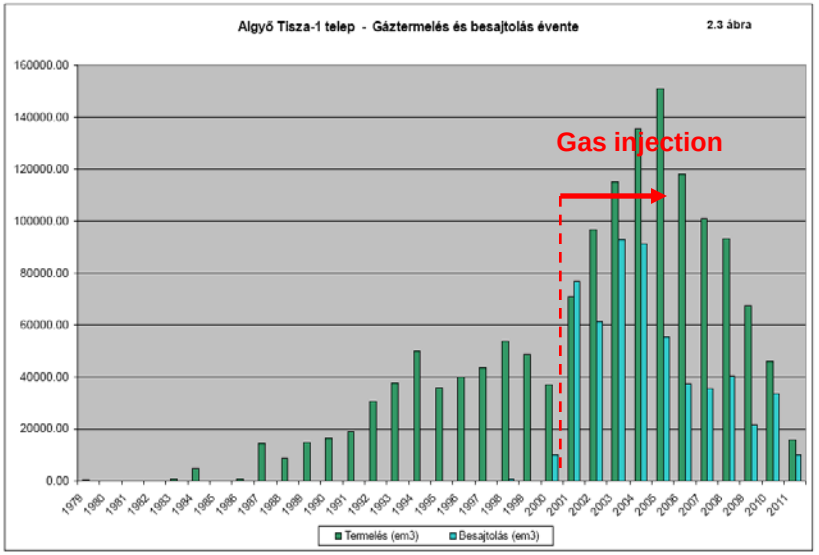

Low temperature propane extraction plant (LTEX)
Hydrogen-sulphide removal unit
Liquefied HC products storage park
Middle pressure gas processing plant
Compressor plant
Fractionation plants
High pressure gas processing plant
Compressor plant
Flares

Results of enhanced recovery of C3-6 components

Oil saturation vs. time by gas injection







Area: 7% **WOC: ~1940 mbsl**

Reservoir temperature: 92 C°

Initial reservoir pressure: 169.8 bar

Oil density: 728 kg/m^3 **Boi: 3.97**

OIIP: 2.29 MMm^3

Solved GIIP: 1.6 bcm

Cum. Oil with primary recovery: 0.66 MMm^3

Cum. Oil on 31 December 2012: 1.4 MMm^3

13% RF increment in C3-C6 components

EOR/IOR in Demjén oil field – Location of the field

Reservoirs of Demjén field:

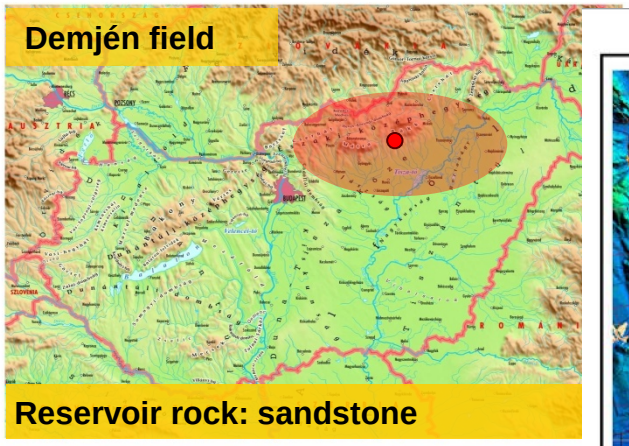
Demjén-West

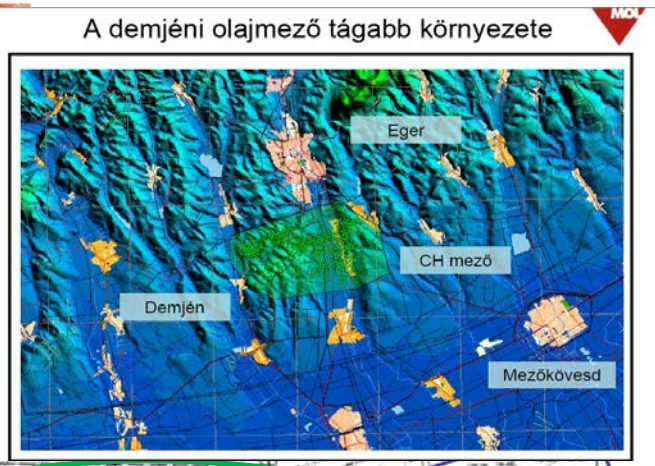
Demjén-Pünkösdhegy

Demjén-East

Permeability: 10-100 mD

Average: 80-100 mD





Oil characteristics:

Demjén-West:

Density: 890 kg/m3

Pour point: +35 C°

Viscosity: 49 mPas@29C°

Demjén-East:

Density: 840 kg/m3

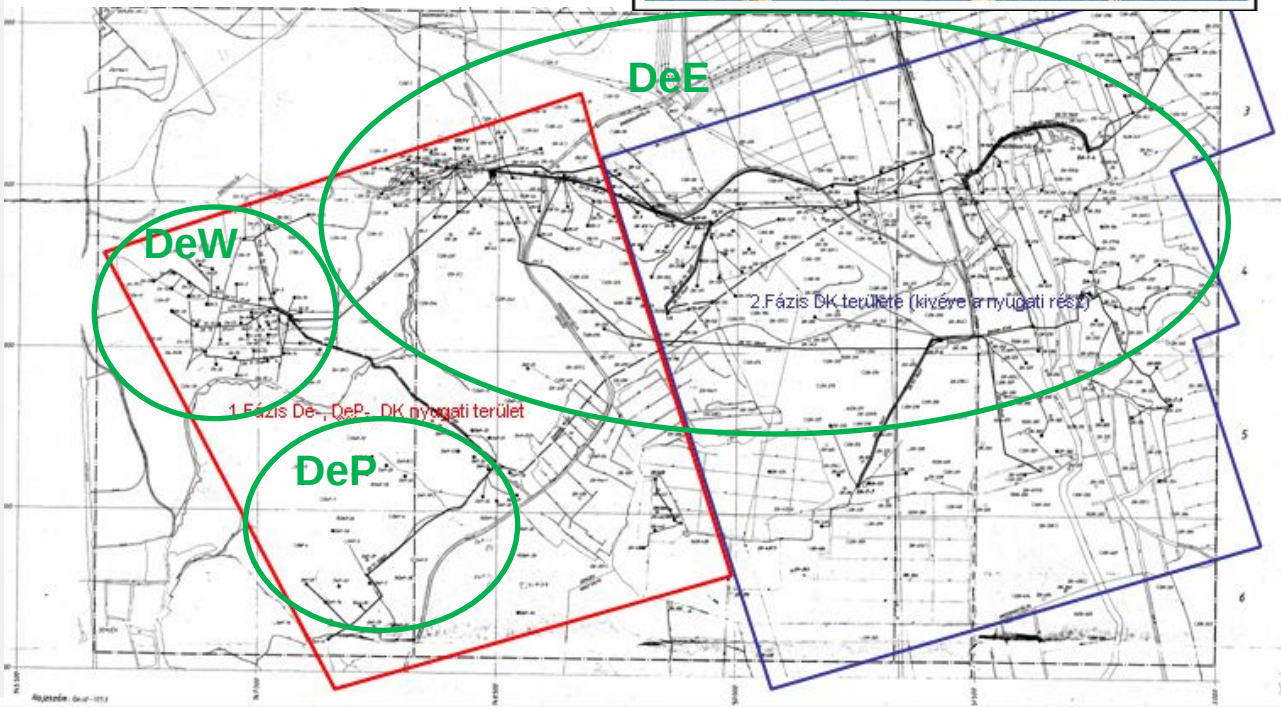
Pour point: +5 C°

Viscosity: 5 mPas@38C°

Demjén-Pünkösdhegy:

Mix

High paraffin content

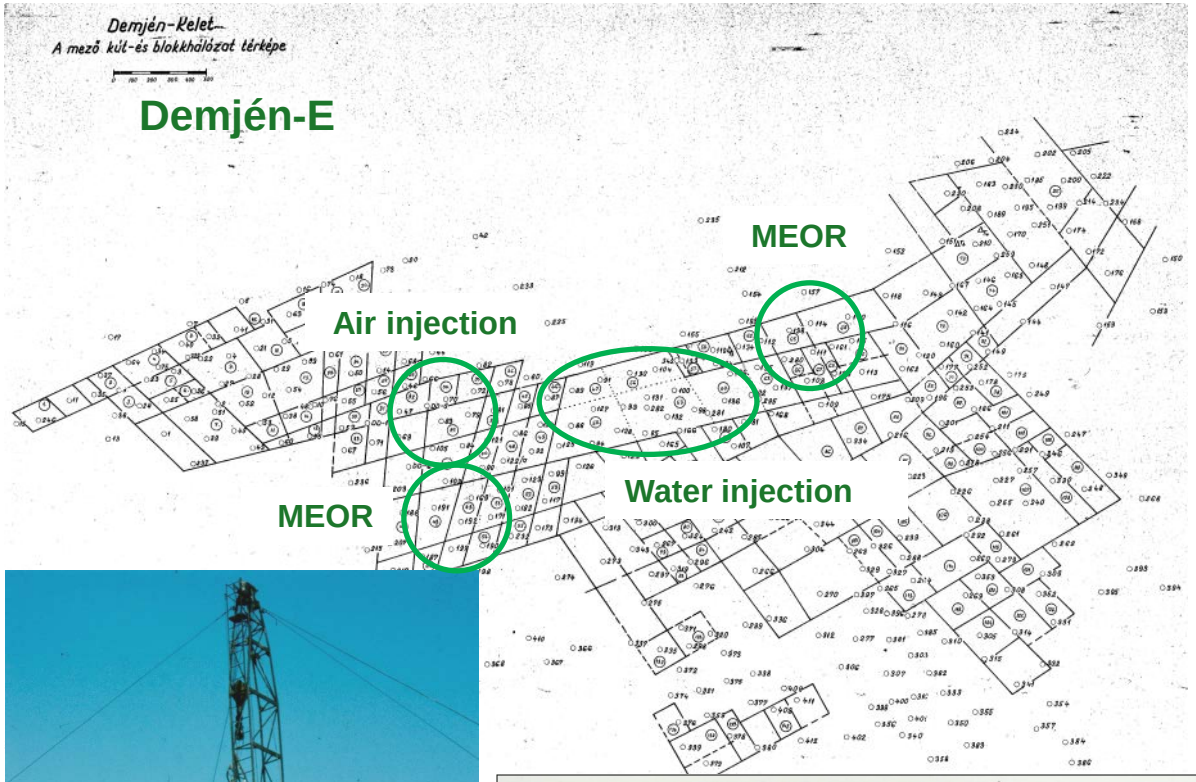


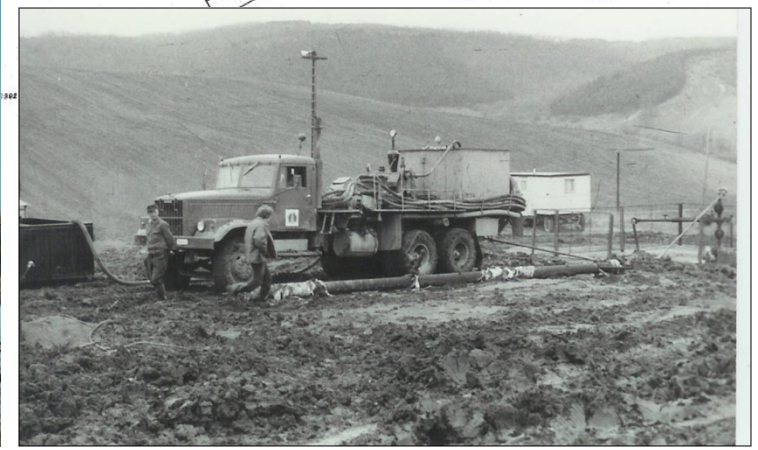
Demjén field – A playground of EOR/IOR experiments

Small scale pilot projects

Demjén-East:

- Micro bacterial (MEOR) experiments in Dk-114,-192 and De-61 wells – 1969-1970. Well treatments, production increased.
- Air injection (segregation project) in to Dk-83 – artificial gas cap, good results.
- Water injection resulted 317 th m^3 incremental oil.



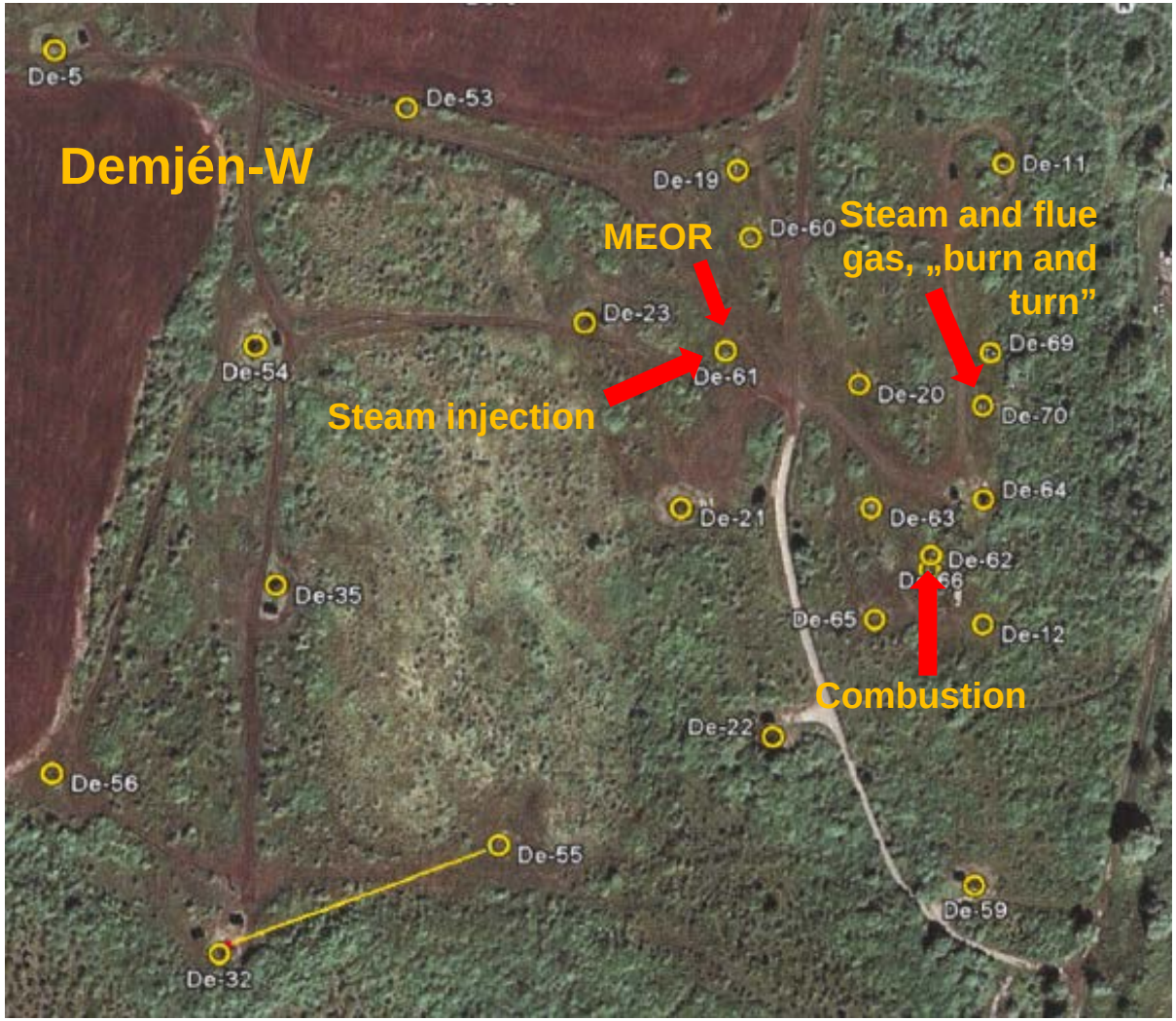


Demjén field – A playground of EOR/IOR experiments

Small scale pilot projects

Demjén-West:

- Steam injection experiment in De-61 well in 1969 – minimal results
- Dry in situ combustion pilot in De-62 well in 1972
- Steam - flue gas injection experiment in De-70 in 1989 – good results, incremental oil production.
- „Burn and turn” project on De-70 well in 1991 – good results, 648 tons incremental oil in one year on a small area.

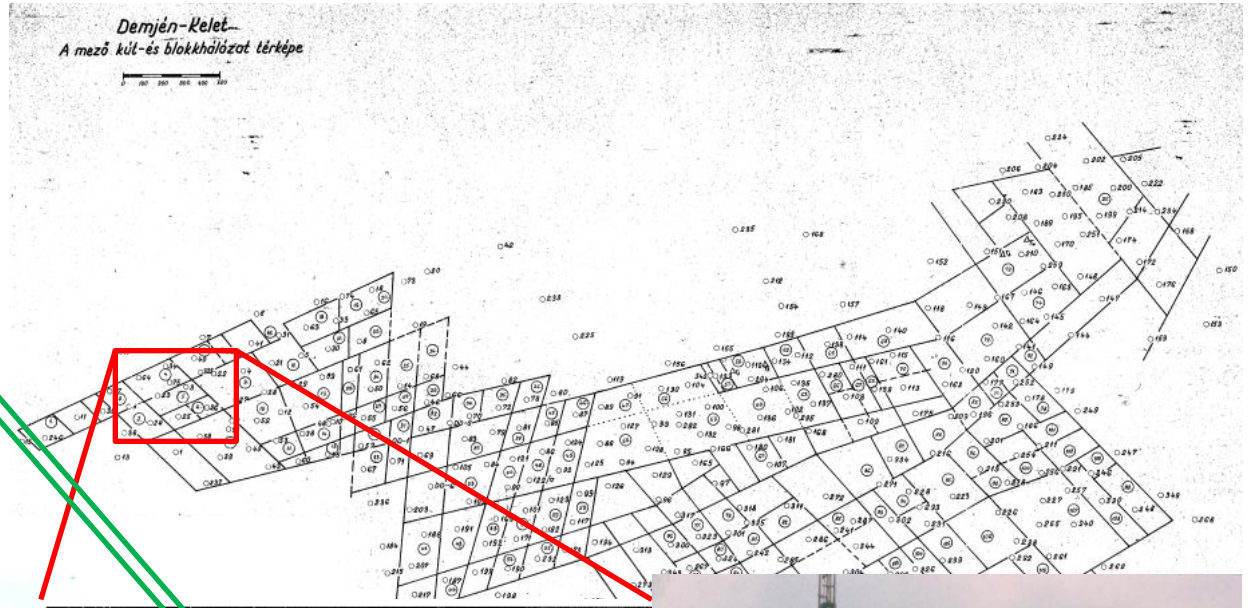


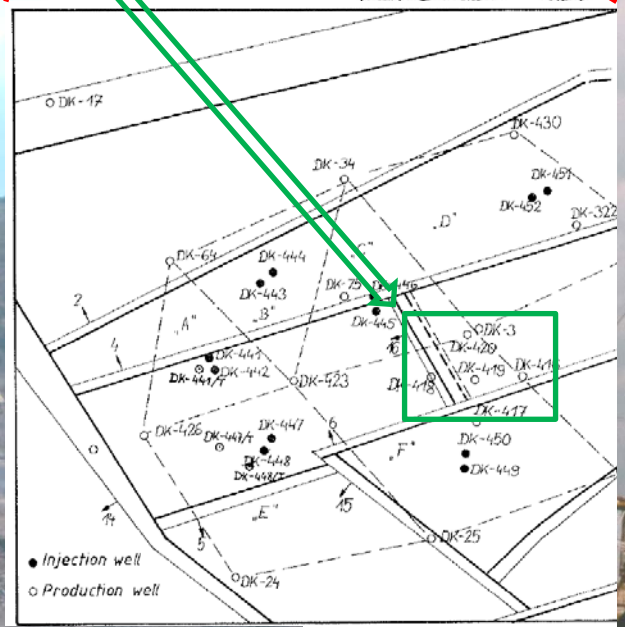
MOLGROUP

In-situ combustion projects in Demjén-East field

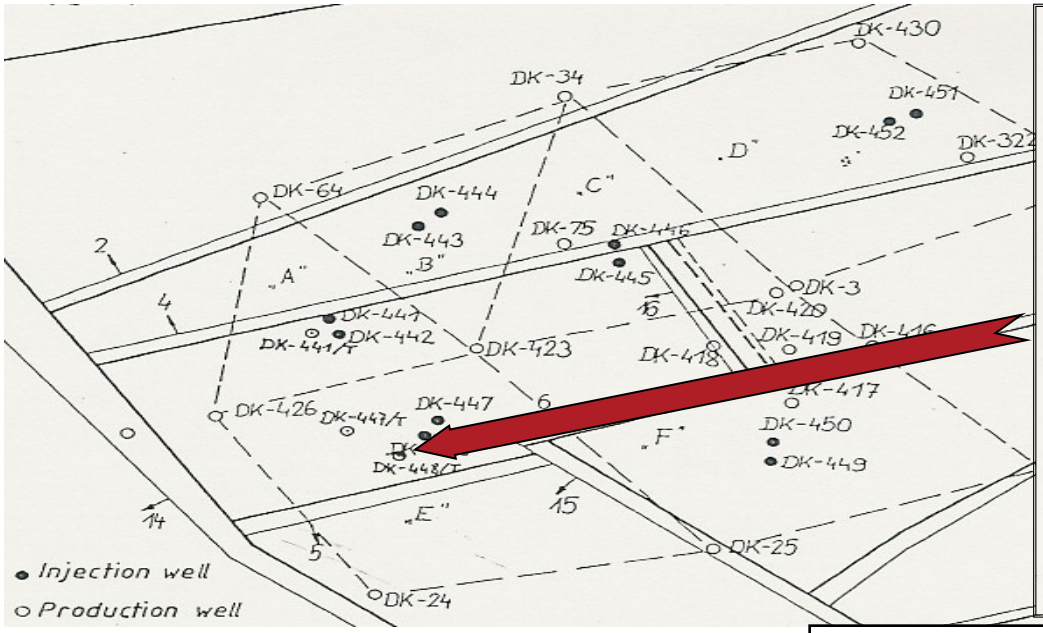
In-situ combustion experiments in Demjén field:

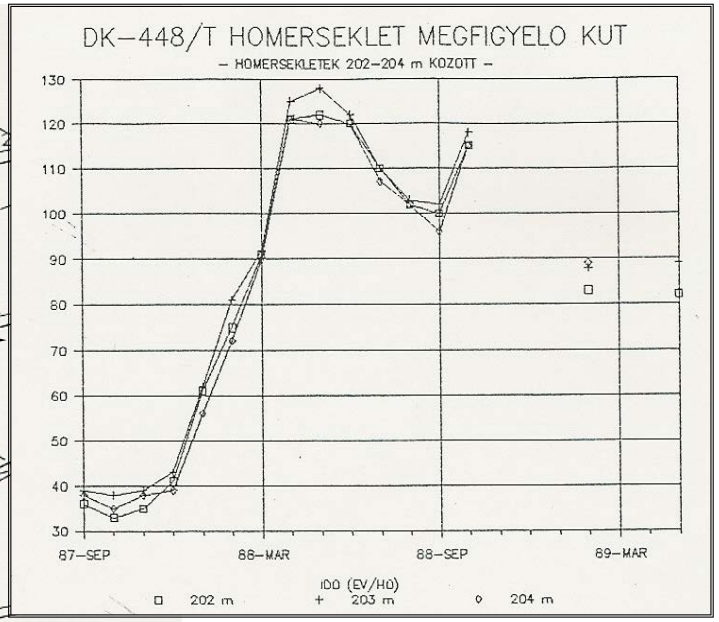
- 1976: experiment with chemical additive in Demjén-E in a 5-well pattern
- 1986: wet combustion pilot project in Demjén-E in three 4-well and three 5-well patterns



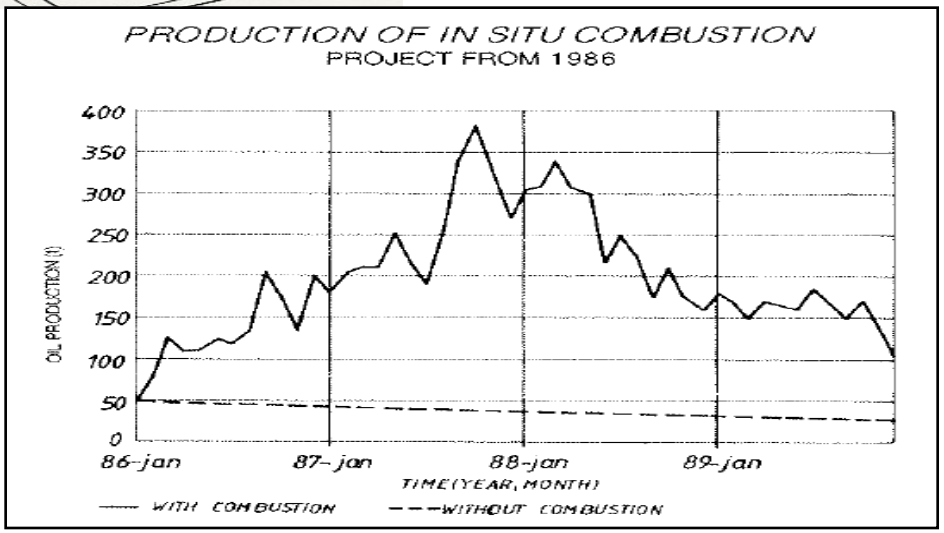


Temperature raising and results





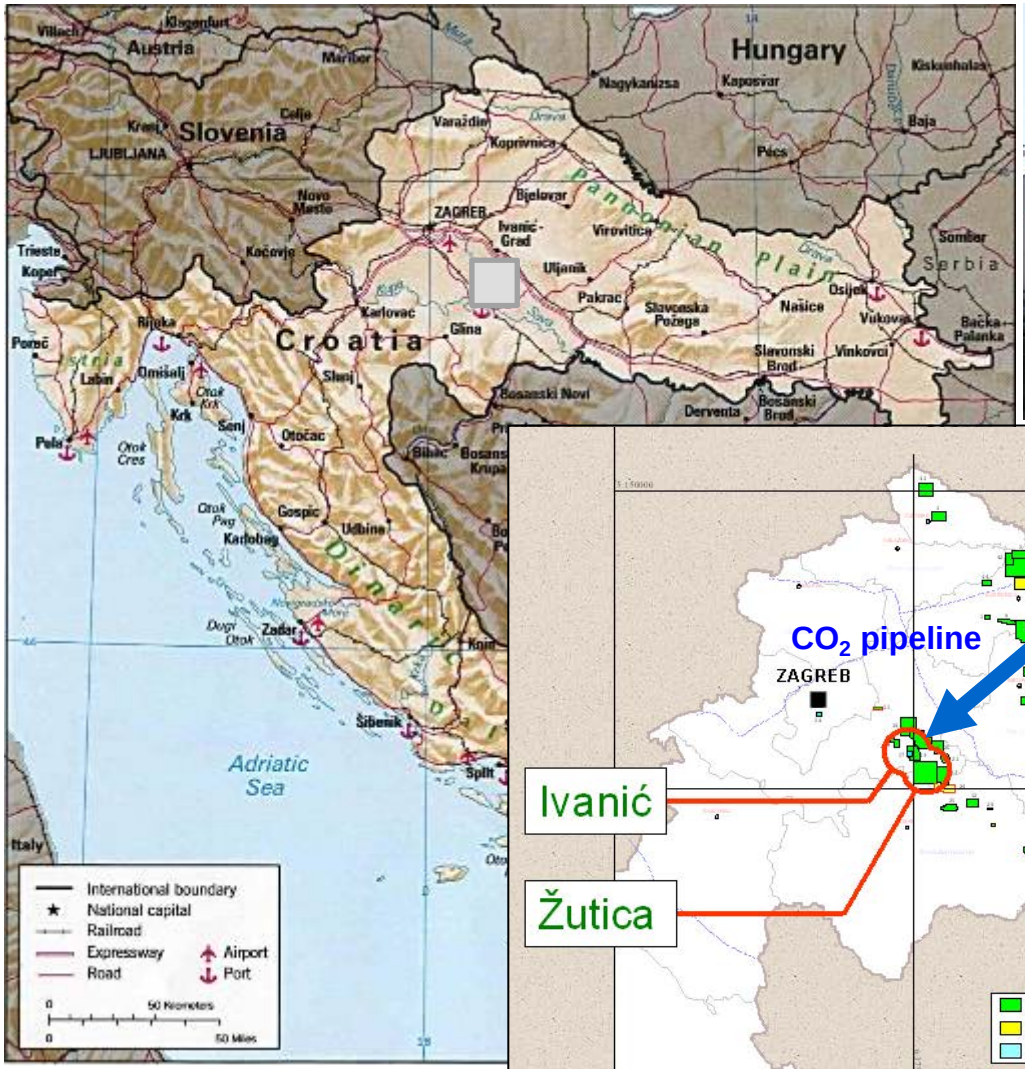
- **9 injectors were ignited,**
- **Production grew rapidly but high production rate from the area was short,**
- **cumulative production was 5-fold of the forecasted (incremental oil 11.2 th m^3),**
- **Combustion front caused damage in production wells,**
- **Controlling front and flooding was a challenge.**

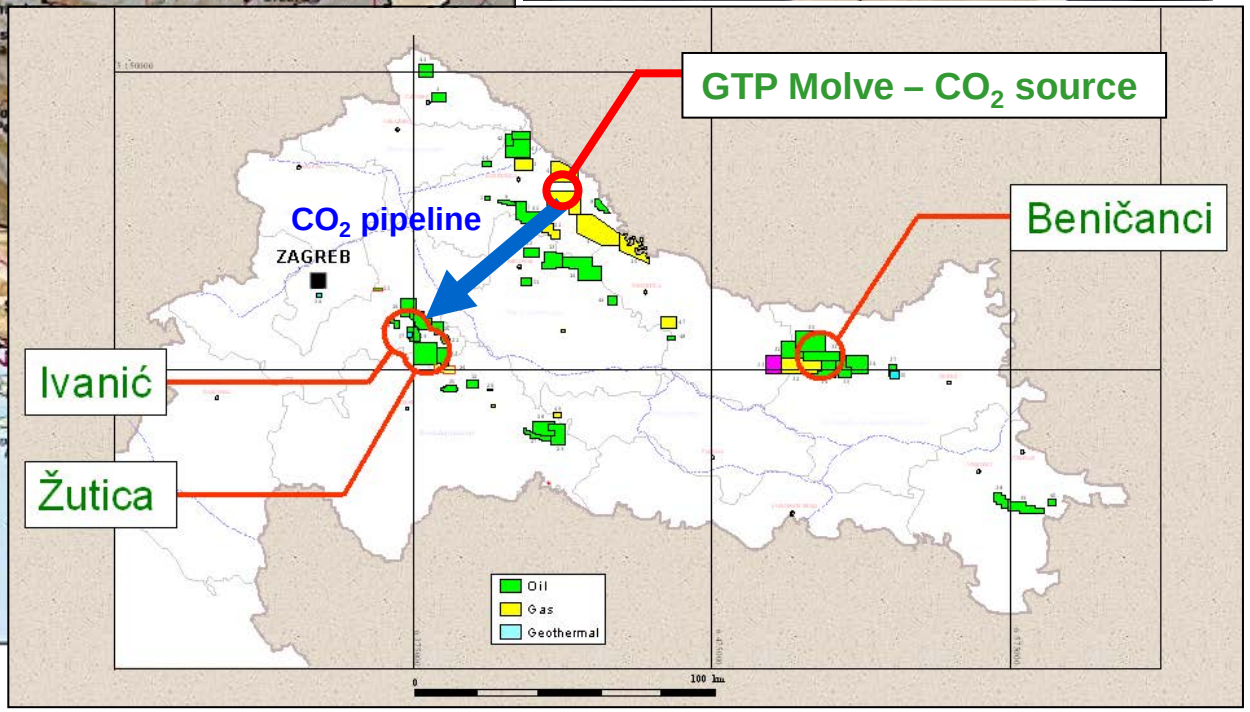


Contents

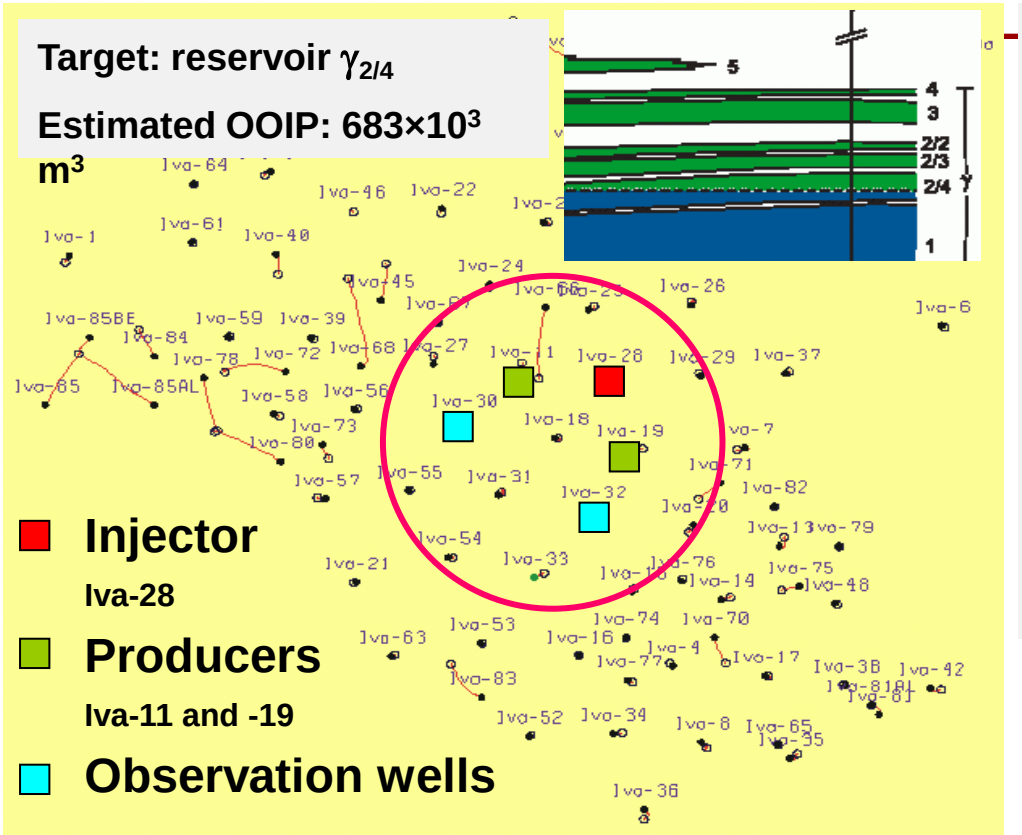
4. **Ongoing EOR activities in the Pannonian basin**

Ongoing CO_2 (WAG) project in Ivanić–Žutica fields





CO_2 injection pilot proved the feasibility of the project



CO_2 injection data

- Two slugs
  - ➔ one slug is one year
  - ➔ in one slug appr. half year CO_2 and half year water injection
- Injection rate:
  45,000 Sm^3/day (88 t/day)
- Wellhead: p = 55 bar, T = -20°C
- Downhole: p = 193 bar, T = 60°C
- Slug size: 8.2 × 10^6 Sm^3 (16,000 t)
- No operational problems

CO_2 injection results

- **Confirmation of oil displacement by CO_2 in real reservoir environment**
- **Source of data for fine tuning of simulation models: pilot area and full field**
- **Practical experience with:**
  - **CO_2 injection (including safety systems)**
  - **Oil production after CO_2 breakthrough**

EOR – Scope of the project

Facilities: CO_2, Liquefaction and pumping station

600.000 m³/d

Facilities: CO_2 Compressor station

1st PHASE

Ivanić
Žutica North

• INJECTORS:
22 WAG, 8 DISPOSAL
PRODUCERS: 76

400 000 m³/d

200 000 m³/d

2nd PHASE

Žutica South

INJECTORS:
23 WAG, 5 DISPOSAL
PRODUCERS: 85

600 000 m³/d

EOR 1st phase – finalization

- **Received (3) use permits for CS Molve, CS Ethane and membrane separator unit on CS Žutica;**

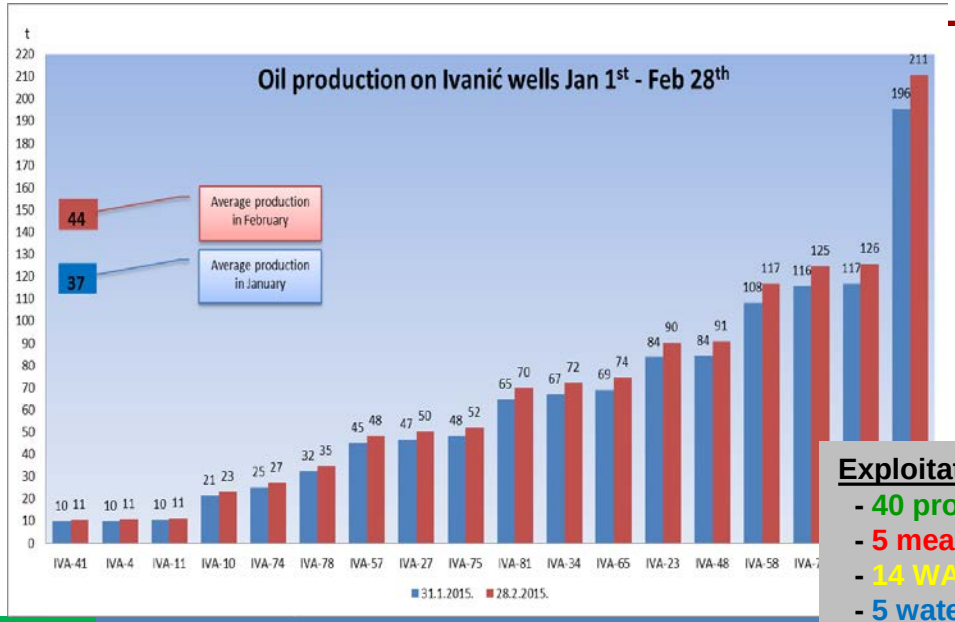
- **July 18th- September 9th functional testing of CO_2 system (CS Molve, CS Ethane and 11 wells on Ivanić);**

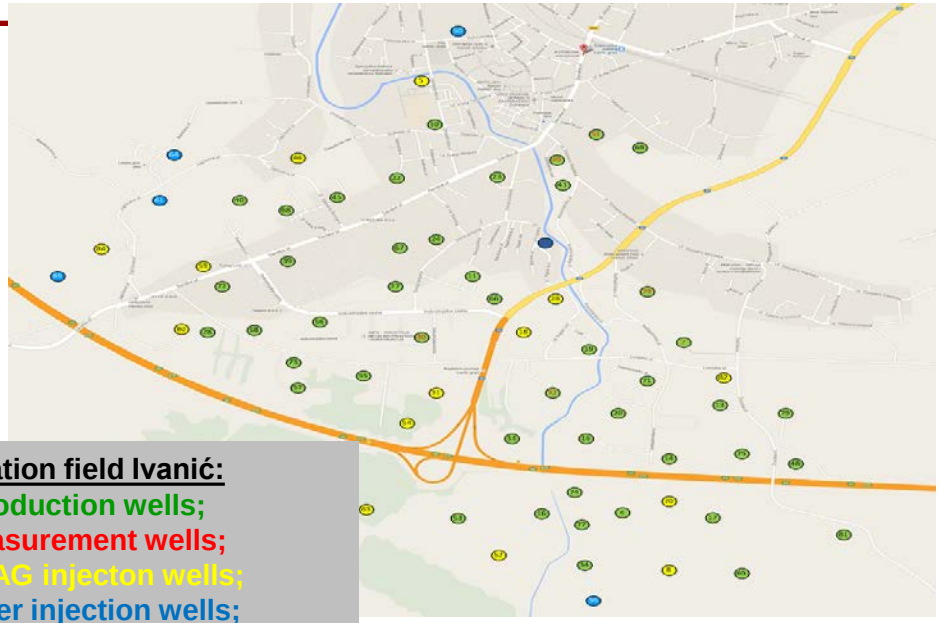
- **September 30th received approval from Ministry for trial exploitation of the CO_2 system and CO_2 injection into 12 wells;**

- **October 14th CO_2 injection started into 12 wells in Ivanić;**

- ***Decision for EP Žutica concession approval till the end of September 2015 has been received from Ministry.***

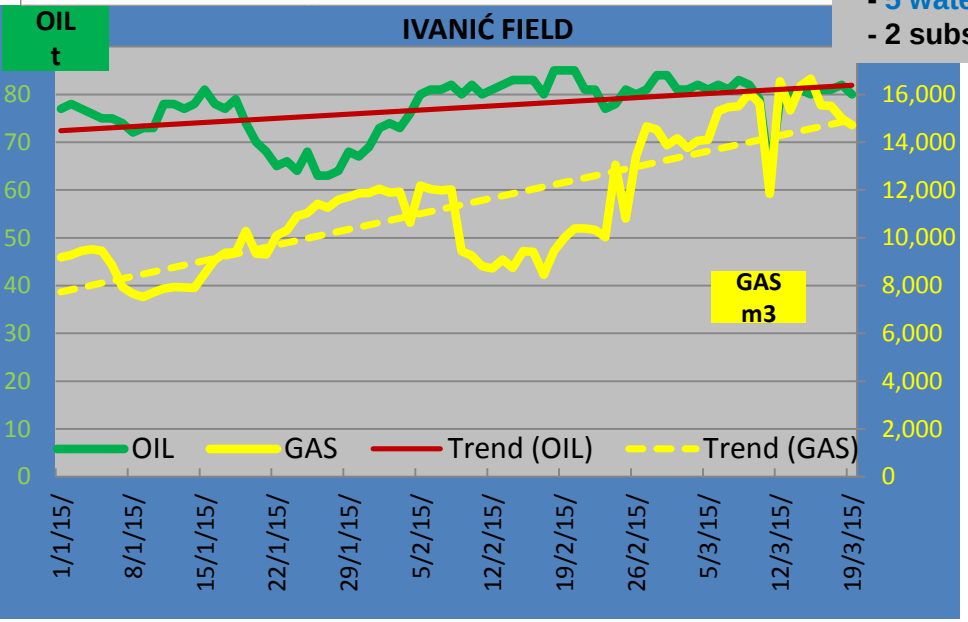
Early results of CO_2 injection on oil production

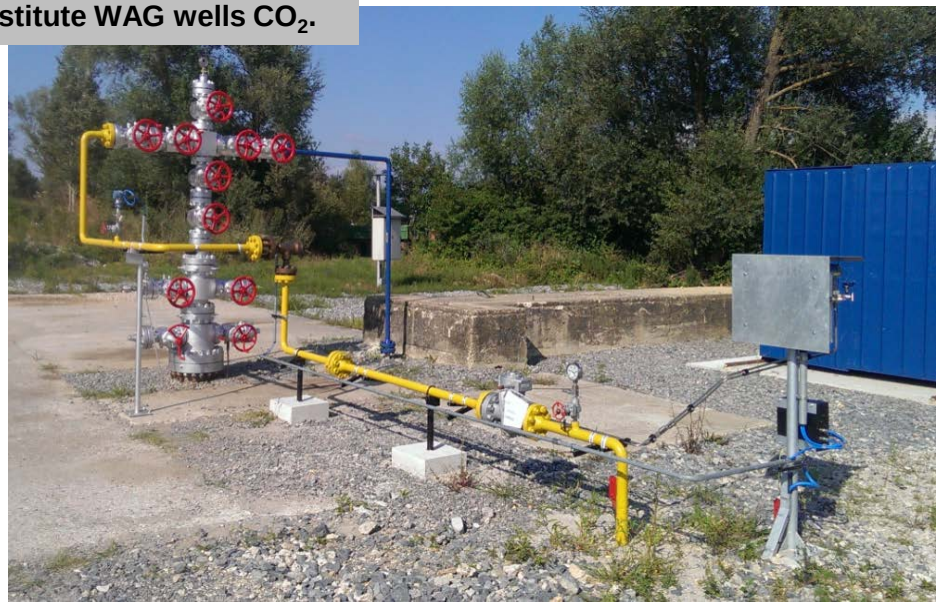




Exploitation field Ivanić:

- 40 production wells;
- 5 measurement wells;
- 14 WAG injecton wells;
- 5 water injection wells;
- 2 substitute WAG wells CO_2.





General information on EOR related R&D projects

Projects in field testing phase

1. Reducing water inflow in gas wells by injecting metastable micro emulsion
2. Application of micro and macro heterogenous gels for fluid flow improvement
3. Polymer-surfactant flooding in Algyő field
4. Profile control and EOR by applying biotechnology

Supported area

Reservoir technology

Current phase of the projects

Applied research

Strategic objective

Increase recovery factor

TRL classification

In most cases 6

Project 1.

Reducing water inflow in gas wells by injecting metastable micro emulsion

Project description	work out a simple, economical and routinely applicable well service method that is suitable for limiting water production from gas fields and from UGSs
Target of project	average 30-40% less formation water and hereby more HC production 503,200 boe (80 Mm^3) gas for Y2015
Milestones in 2014	3 wells were treated. Water production decreased by 30-50%
Activity in 2015	well injection test in further 4 gas wells

Project 2.

Application of micro and macro heterogenous gels for fluid flow improvement

Project description	improve efficiency gels for correcting conditions of fluid flow in porous and fractured reservoirs
Target of project	less formation water production, stop the decreasing oil production rate and sustain the production at the estimated yearly level
Activity in 2014	prepare the selected wells for testing and optimise the applied chemical compound
Activity in2015	well injection tests in further 4 oil wells

Project 3.

Polymer-surfactant flooding in Algyő field

Project description	using more effective Gemini surfactant with polymers for EOR. Goal of the development is to expand chemical EOR to high temperature reservoirs.
Target of project	successful pilot project in a 2 injectors 5 producers well pattern
Activity in 2014	polymer-surfactant backflow test in well Algyő-758 was completed, preparation for a multi-well pilot.
Activity for 2015	elaborate a multi-well pilot, prepare wells for treatment

Project 4.

Profile control and EOR by applying biotechnology

Project description	Develop bio-tenside, bio-polymers and bio-surfactant bio-polymer complex mixtures that can be used for MEOR,
Target of project	average 20-30 % overall oil production increase
Activity in 2014	bacteria-bio-surfactant-biopolymer mixture injectivity test in Demjén-W field was completed. Prepare injection wells and the connecting surface technology.
Activity in 2015	microbiological analyse of produced fluids from monitoring wells

Results

Output

Incremental production in Y2014:

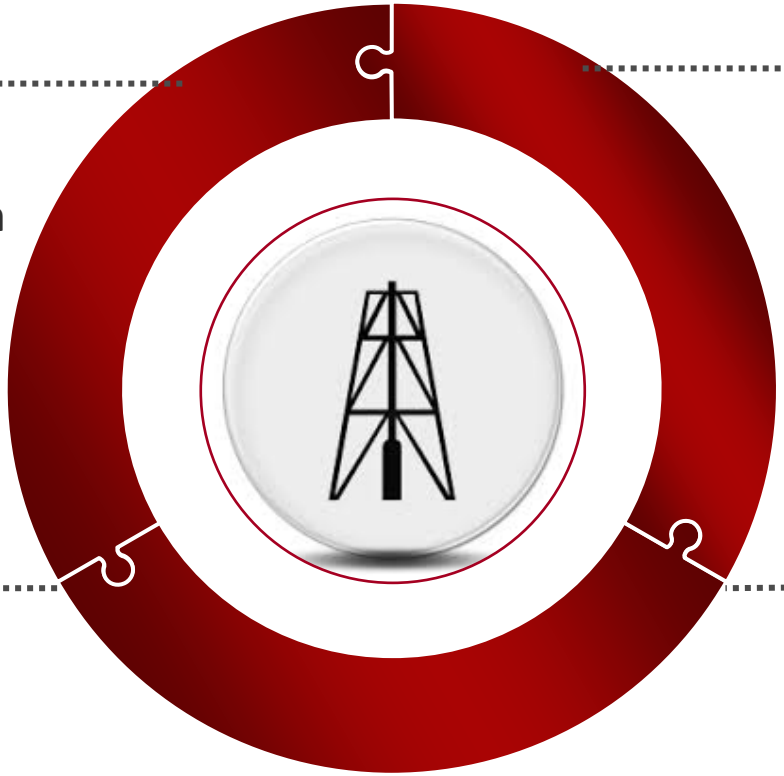
33 470 bbl oil

34 732 boe gas

Expected **incremental production** for Y2015:

279 000 bbl oil

518 925 boe gas



and moreover

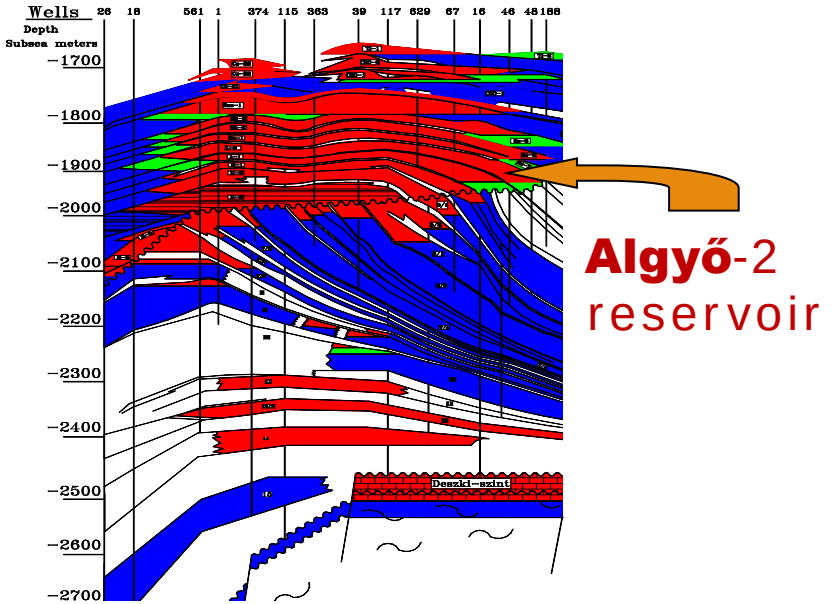
less water production

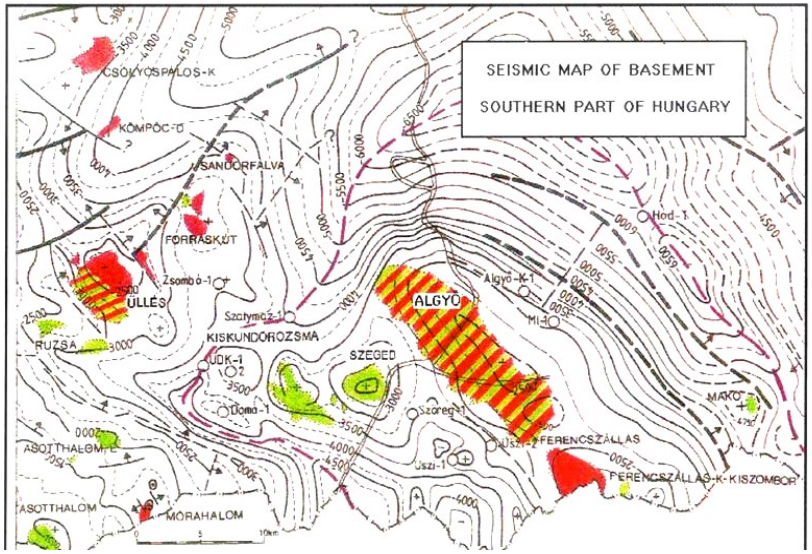
less operational and maintenance cost

Contents

5. EOR plans for the future

Polymer–surfactant flooding in Algyő field





Algyő field was discovered in 1965

Algyő is the largest HC accumulation in Hungary: 500 MMbbl OOIP, 4 TCF OGIP

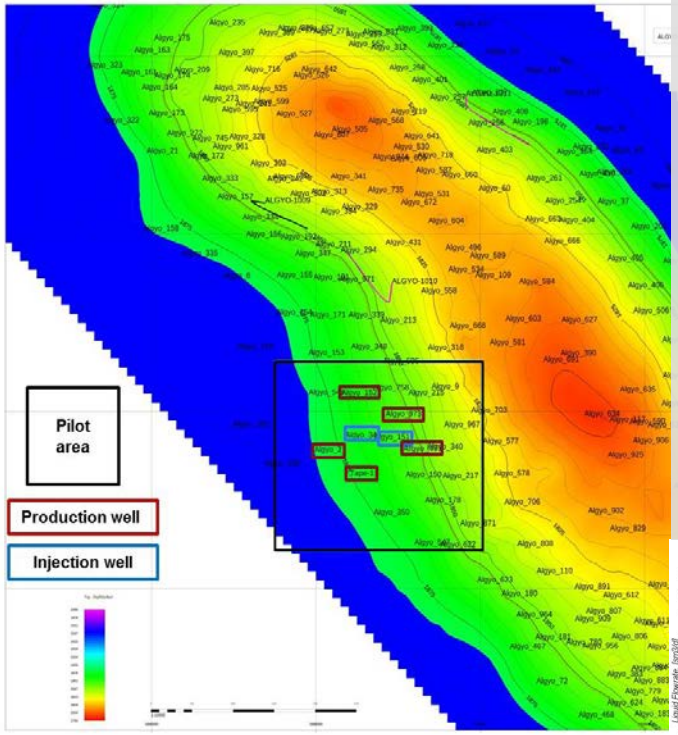
Pannonian deltaic reservoir system

Algyő-2 is one of the 77 reservoirs in the field:

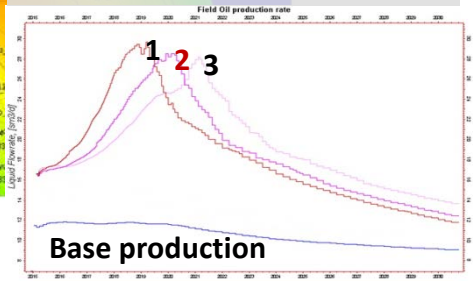
- **Type of reservoir:** sandstone
- **Porosity:** 23-26%
- **Permeability:** 200-300 mD
- **STOOIP:** 141 MMbbl
- **Produced till November 2014:** 64,8 MMbbl (46% RF)

Polymer–surfactant flooding in Algyő field – Pilot project

2 injection wells	5 production wells
Water-supply system	Water treatment system
Surface technology related containers, tanks	Electrical supply system



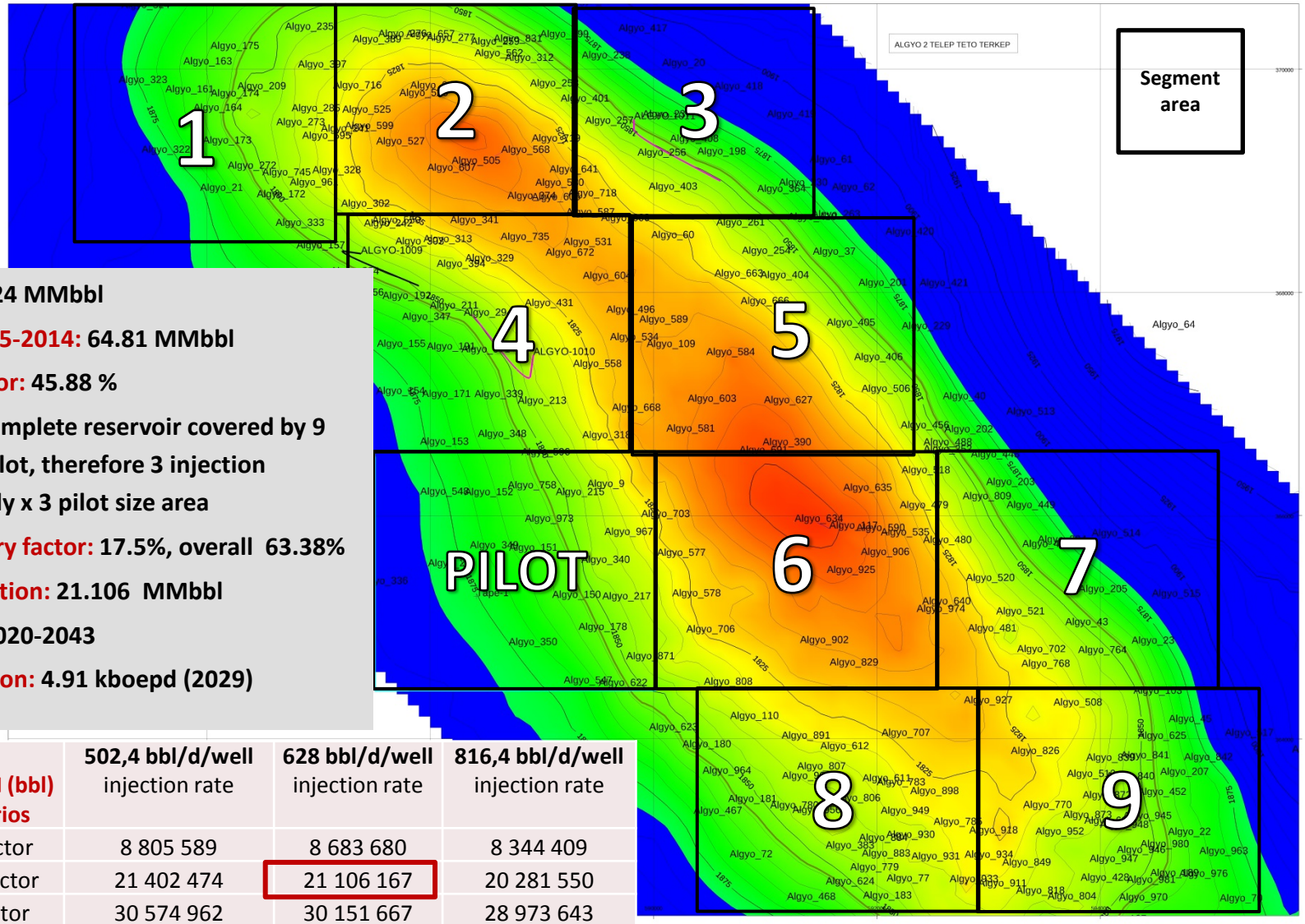
- **Criteria:** 1/3 pilot area pore volume equivalent injected surfactant –polymer solution
- **Injection rate (Scenario 2):** 628 bbl/d/well preferred both technically and economically
- **Chemical injection:** 2015-2019
- **Water injection:** from 2019 2/3 pv
- **Target production:** 676 225 bbl
- **Incremental RF:** 17.5%



2015	January	February	March	April	May	June	July	August	September	October	November	December
IPP – prepare and approval												
	Well workover and injectivity tests											
	Detailed engineering and procurement											
									Water clarify and supply technology set up			
									Injection technology set up			
										Pilot chemical injection start up		

MOLGROUP

Polymer–surfactant flooding in Algyő – Full scale project



- **STOOIP:** 141.24 MMbbl
- **Produced 1965-2014:** 64.81 MMbbl
- **Recovery factor:** 45.88 %
- **Up-scaling:** complete reservoir covered by 9 segments + pilot, therefore 3 injection simultaneously x 3 pilot size area
- **Target recovery factor:** 17.5%, overall 63.38%
- **Target production:** 21.106 MMbbl
- **Timeframe:** 2020-2043
- **Peak production:** 4.91 kboepd (2029)

TOTAL PRODUCTION (bbl) in different scenarios	502,4 bbl/d/well injection rate	628 bbl/d/well injection rate	816,4 bbl/d/well injection rate
7.2 % Recovery Factor	8 805 589	8 683 680	8 344 409
17.5 % Recovery Factor	21 402 474	21 106 167	20 281 550
25 % Recovery Factor	30 574 962	30 151 667	28 973 643

EOR/IOR in Demjén oil field – Location of the field

Reservoirs of Demjén field:

Demjén-West

Demjén-Pünkösdhegy

Demjén-East

Permeability: 10-100 mD

Average: 80-100 mD

Oil characteristics:

Demjén-West:

Density: 890 kg/m3

Pour point: +35 C°

Viscosity: 49 mPas@29C°

Demjén-East:

Density: 840 kg/m3

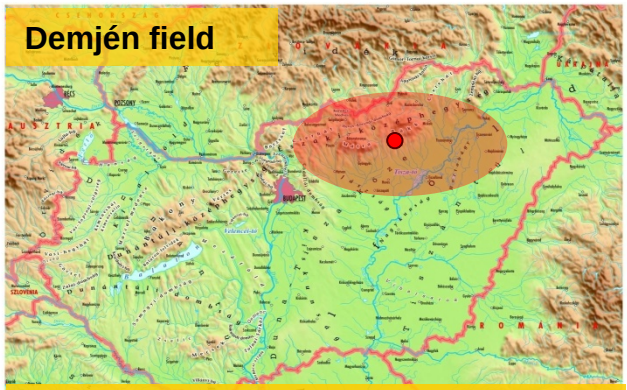
Pour point: +5 C°

Viscosity: 5 mPas@38C°

Demjén-Pünkösdhegy:

Mix

High paraffin content



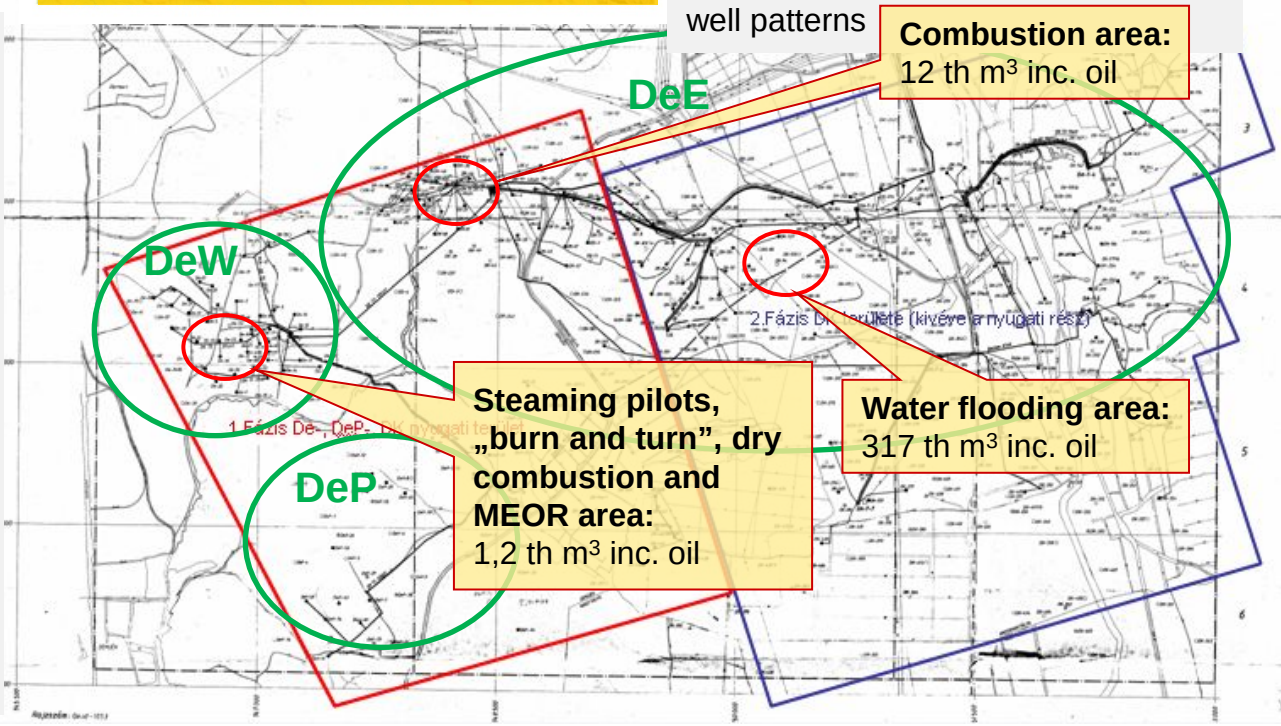
Reservoir rock: sandstone

In-situ combustion experiments in Demjén field:

1972: first experiment in Demjén-W in a 5-well pattern

1976: experiment with chemical additive in Demjén-E in a 5-well pattern

1986: wet combustion pilot project in Demjén-E in three 4-well and three 5-well patterns



MOLGROUP

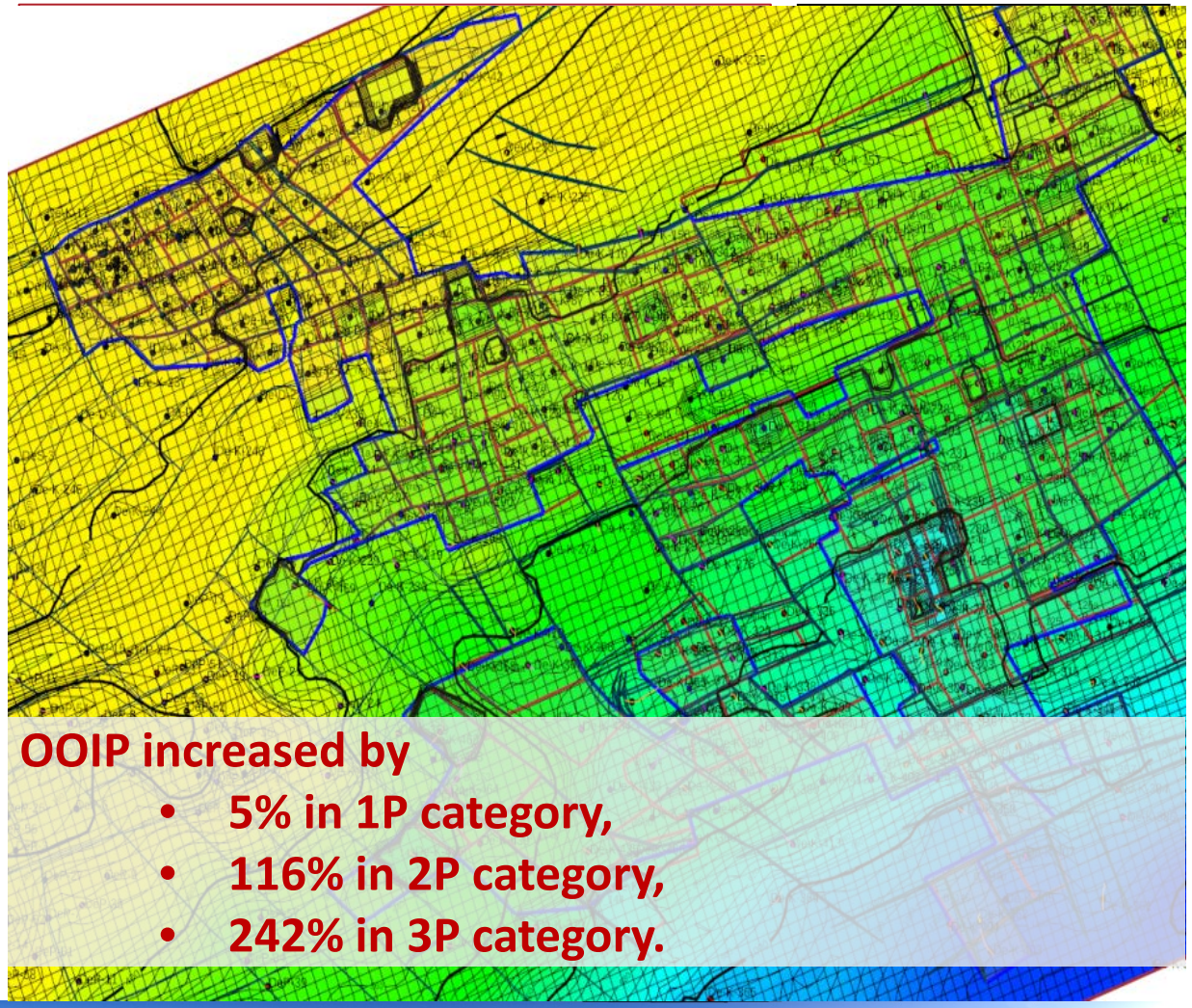
Complex EOR/IOR program design for Demjén field

Cautious estimations regarding results of IOR/EOR applications:

– **Water + new wells:** 166 thcm

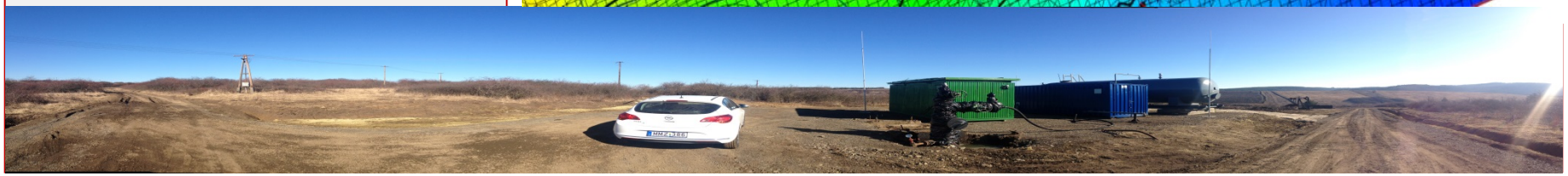
– **Water + new wells + perforation modifications:** 342 thcm

– **Further incremental oil production up to:** 1 178 thcm



OOIP increased by

- **5% in 1P category,**
- **116% in 2P category,**
- **242% in 3P category.**



Incentives for production enhancements

Hungary: Mining Act (Bt.)

- **Bt.20§(5): royalty is 0%** for the volume of **HC produced** with „enhancement technologies”,
- **Bt.49§ 25.:** „enhancement technologies” means those applications what **increases the HC production after primary and secondary recovery**,
- **Bt. Enacting Clauses 4§(10)-(10a):** a technology can be considered to „enhancement technology” if its **effect on reserve increase is proven**.

UK: Oil and gas taxation

- **Types of field allowances:** Small Field (SFA) from 2009, Ultra Heavy Oil Field (UHO) from 2009, Brown-field (BFA) from 2012,
- Applicable against 32% supplementary tax,
- Maximum **UHO allowance** per field **800 GBPmln** reduces tax paid up to **256 GBPmln**,
- Maximum **BFA** per field **250-500 GBPmln** reduces tax paid up to **80-160 GBPmln**.

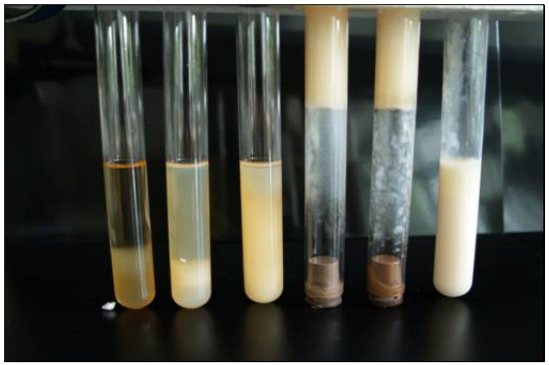
Other tax and/or royalty allowances exist in Canada, Mexico, Russia, etc.

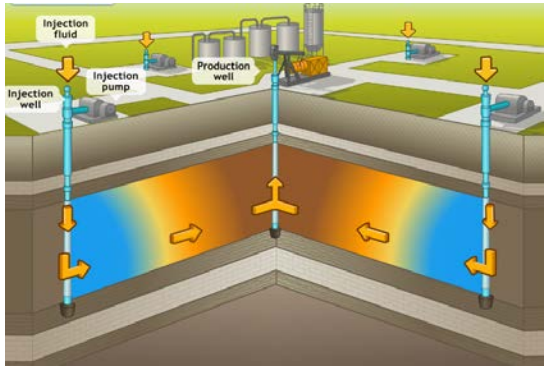
Contents





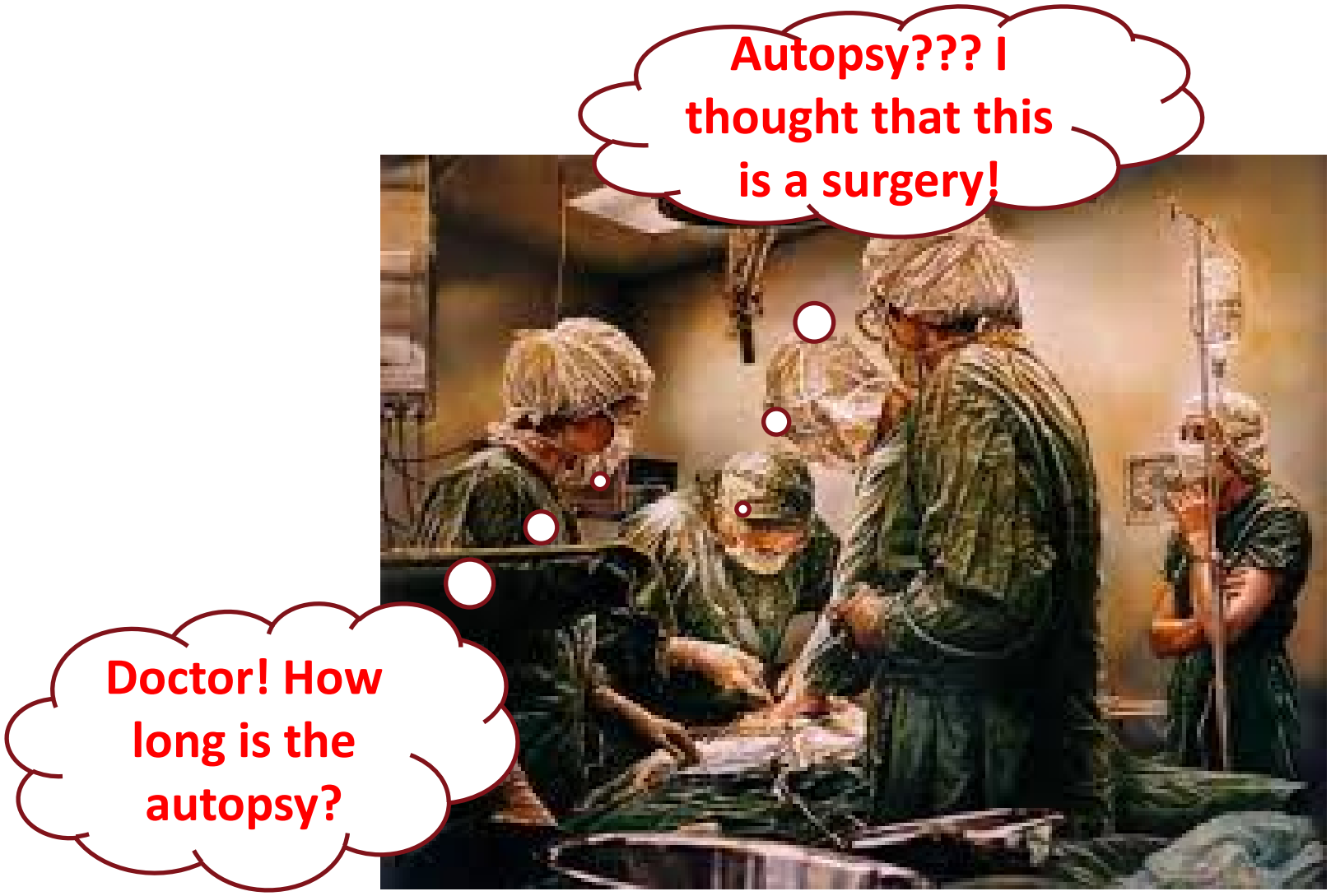

Conclusions





- A good farmer cares about its sheep – strategy for production portfolio management is crucial to optimize the performance.
- Regular EOR/IOR screening of assets is important to know the actual future potential of our producing assets.
- Do not forget the past experiences either positive or negative – use it for future development.
- R&D is an important tool to develop and implement new technologies for higher production efficiency and recovery, for future oil and gas.
- Speed of transforming idea to project implementation can be critical in case of an old field.

Do not let to die your field…



MOLGROUP

Thank you for your kind attention!

MOLGROUP
THINK. CREATE. MOVE.